

M.Sc., Biomedical Science, Department of Zoology, Periyar University

**PERIYAR UNIVERSITY
DEPARTMENT OF ZOOLOGY
Salem-636011, Tamil Nadu**

NAAC "A++" Grade - State University – NIRF Rank 59, NIRF Innovation Band of 11-50

**M.Sc.,
BIOMEDICAL SCIENCE**

SYLLABUS

**FROM THE ACADEMIC YEAR
2023-2024 ONWARDS**

**M.Sc. BIOMEDICAL SCIENCE PROGRAMME
[Choice Base Credit System (CBCS)]
(For those admitted in the academic year 2023-2024 onwards)
OBE REGULATIONS AND SYLLABUS
(With effect from the academic year 2023-2024 onwards)**

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Introduction

The Master's programme in Biomedical Sciences provides a unique combination of fundamental research and clinical application, with a special focus on multidisciplinary aspect such as biochemical, molecular and patho-physiological mechanism of diseases. Investigating and understanding the diseases give the skill and knowledge to work towards discovery and development of preventive/ therapeutic drugs. There is an increasing prevalence of non-communicable diseases as a result of lifestyle changes and urbanization in India. Infectious diseases are also still persisting as major health problems in Indian population. These are the challenges that are to be tackled in the new millennium, so there is a need to understand the pathogenesis and to develop the new markers and diagnostic protocols with respect to the relevant field. The requirement for Biomedical Scientist is important because they are expected to bridge the gap between biomedical research, diagnostics and clinical applications.

Objectives

To improve the skills and critical thinking in the field of clinical research To understand the pathogenesis and to develop the new markers and diagnostic protocols with respect to the relevant field.

Learning Outcomes

Display a sound knowledge of the biology of disease and its clinical applications. Be able to discuss current knowledge in biomedical sciences, and the techniques used in their investigation. Possess skills in the selection, planning, performance and interpretation of a range of appropriate experimental techniques. Be able to analyse and interpret complex and sometimes contradictory scientific information. Be able to engage in professional and academic communication with other biomedical scientists. Develop an informed, critical and imaginative attitude to professional practice appropriate for those with responsibility in the field.

Job Opportunities

On successful completion of the course, the Biomedical Science graduates could contribute to the Private sector or National healthcare laboratories

- Testing and screening of life style disorders (Diagnostics)
- Investigating and understanding the disease mechanisms (Research fellow)
- Working towards discovery and development of treatments, which could be preventive (vaccines) and/or therapeutic (drugs and medicines-R & D)
- Working in academic institutions (Higher education)

M.Sc., Biomedical Science, Department of Zoology, Periyar University

AS PER TANSCHÉ REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION IMPLEMENTED IN PERIYAR UNIVERSITY, SALEM.	
Programme	M.Sc., Biomedical Science
Programme Code	
Duration	PG-2 Years
Programme Outcomes (Pos)	<p>PO1: Problem Solving Skill</p> <p>Demonstrate an in-depth knowledge of human biomedical sciences, from molecular to whole body systems with an interdisciplinary understanding of human function to design an experiment that functions well despite challenging parameters, or to create a new type of experiment should a first experiment fail</p> <p>PO2: Decision Making Skill</p> <p>Develop healthcare system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. Foster analytical and critical thinking abilities for biomedical data-based decision-making.</p> <p>PO3: Ethical Value</p> <p>Apply rigorous academic integrity and ethical scholarly practices to their own learning, and understand their application and importance in biomedical science and health research.</p> <p>PO4: Communication Skill</p> <p>Communicate and advocate for evidence-based scientific ideas and knowledge in diverse expert, non-expert and interdisciplinary settings</p> <p>PO5: Individual and Team Leadership Skill</p> <p>Ability can help them coordinate with their research teams to perform experiments correctly. Many experiments require</p>

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	<p>precision and teamwork.</p> <p>PO6: Employability Skill</p> <p>To enhance their knowledge and to develop their practical, intellectual and key skills to assist them in their career development.</p> <p>PO7: Entrepreneurial Skill</p> <p>Equip with skills and competencies to become an entrepreneur.</p> <p>PO8: Contribution to Society</p> <p>Respectfully engage with Indigenous perspectives and cultures, and incorporate Indigenous ways of knowing into a broad understanding of biomedical science and health contexts.</p> <p>PO 9 Multicultural competence</p> <p>Work effectively and respectfully, both individually and in groups to meet a shared goal with people from diverse disciplinary, community and cultural backgrounds</p> <p>PO 10: Moral and ethical awareness/reasoning</p> <p>Apply knowledge of human biomedical sciences to understand societal and environmental determinants of health and disease, and their impacts at an individual, community and population level</p>
<p>Programme Specific Outcomes (PSOs)</p>	<p>PSO1 – Placement</p> <p>Major employment areas include diagnostic pathology and clinical laboratories, NHS Blood and Transplant laboratories, private pathology laboratories,</p> <p>PSO 2 - Entrepreneur</p> <p>Apply knowledge acquired to the planning and implementation of research, development and innovation projects in a biomedical research laboratory, a clinical department laboratory or the biomedical industry.</p>

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	<p>PSO3 – Research and Development</p> <p>Read and critically analyse original and review papers on biomedical issues and assess and choose the appropriate methodological descriptions for biomedical laboratory research work.</p> <p>PSO4 – Contribution to Business World</p> <p>Biomedical technologies to the description of phenomena or problems in human or animal biology, with regard to their causes, mechanisms and treatment.</p> <p>PSO 5 – Contribution to the Society</p> <p>Apply logical reasoning based on the knowledge, skills, designing solutions to assess societal, health, safety issues and the responsibilities that go along with the scientific practice.</p>
--	---

Candidate's eligibility for admission

Candidates who have qualified B.Sc., Biomedical Science / Animal Science / Any other Degree related to Biomedical Science / Life Sciences (B.Sc., Microbiology, Biochemistry, Biotechnology, Functional Genomics, Plant Biology and Biotechnology, Animal Science, Zoology, Advances in Zoology, Medical Biotechnology, Applied Microbiology, Medical Microbiology, Paramedical Degrees like B.Sc., Biomedical Science, Anatomy, Physiology, Pharmacy, Human Genetics etc., approved by the Syndicate of Periyar University, Salem.

Duration of the programme

The duration of the M.Sc. Biomedical Science Course shall be over a period of **Two Years** from the commencement of the course. A student shall obtain the M.Sc. Degree in Biomedical Science if he/she has registered, undergone and secured the required minimum credits for all the Core and Elective courses and completed the Project Work / Dissertation within the stipulated time.

M.Sc., Biomedical Science, Department of Zoology, Periyar University

PERIYAR UNIVERSITY SALEM -636 011

Department of Zoology

M.Sc., Biomedical Science Programme

(For the students admitted in the academic year 2023-2024 onwards)

Programme Structure, course work, credit, contact hours and Distribution of Marks

Course Code	Title of Course Work	Credit	Contact Hr / week	Int. Mark	Ext. Mark	Total Mark
SEMESTER - I						
23UPBMS1C01	Biochemistry	5	6	25	75	100
23UPBMS1C02	Cell and Molecular Biology	5	6	25	75	100
23UPBMS1C03	Medical Genetics	4	4	25	75	100
23UPBMS1L01	Core : Lab Course -I	3	6	40	60	100
23UPBMS1E01	Medical Microbiology	3	4	25	75	100
23UPBMS1E02	Biosafety and Bioethics	3	4	25	75	100
		23	30			600
SEMESTER - II						
23UPBMS1C04	Human Anatomy	5	6	25	75	100
23UPBMS1C05	Human Physiology	5	6	25	75	100
23UPBMS1L02	Core : Lab Course -II	4	6	40	60	100
23UPBMS1E03	Bioinstrumentation and Bioimaging Technology	3	4	25	75	100
23UPBMS1E04	Stem Cell Biology	4	4	25	75	100
23UPBMS1N01	Swayam Course	2	Compulsory Course			
23UPBMS1S01	Skill-Enhancement Course (SEC) Animal Cell Culture	2	2	25	75	100
23UPBMS1H01	Human Rights	1	2	25	75	100
		26	30			700
*Students should undertake Internship during the first year vacation for minimum of 15 days						
SEMESTER - III						
23UPBMS1C06	Immunology	5	6	25	75	100
23UPBMS1C07	Pharmacology and Toxicology	5	6	25	75	100
23UPBMS1L03	Core : Lab Course - III	5	6	40	60	100
23UPBMS1C08	Core (Industry Module) – XI - Vaccinology	4	6	25	75	100
23UPBMS1E05	Organ on Chip	3	3	25	75	100
23UPBMS1N02	NME – II IVF Technology	2	3	25	75	100
23UPBMS1I01	*Internship / Industrial Activity	2	-			
		26	30			600
SEMESTER - IV						
23UPBMS1C09	Human Embryology and Endocrinology	5	6	25	75	100
23UPBMS1C10	Biomaterial and Tissue Engineering	5	6	40	60	100
23UPBMS1P01	Project Work & <i>viva voce</i>	7	10	100	50+50	200
23UPBMS1E06	(Industry Entrepreneurship) Nanomedicine and Drug Designing	3	4	25	75	100
23UPBMS1S02	Skill Enhancement Course – II / Professional Competency Skill Molecular Diagnosis	2	4	25	75	100
23UPBMS1I02	Industrial Visit	1	Compulsory for All Students in any one academic year		50	50
23UPBMS1X01	Extension Activity	1	-			
		24	30			650

Total Credits: 99

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Value Added Courses (Certificate will be issued separately – Through Online Mode) *				
Course Code	Title of Course Work	Contact Hours	Marks	Credit
23UPBMS1V01	Life Style Diseases	36 hrs per course	100	2
23UPBMS1V02	Experimental Embryology	36 hrs per course	100	2
Add-on Courses (Certificate will be issued separately- Through Online Mode) *				
23UPBMS1A01	Cancer Therapeutics	36 hrs per course	100	2
23UPBMS1A02	Lab-On-Chip	36 hrs per course	100	2

Furthermore, The TANCHE, Govt. of Tamil Nadu, recommends the candidates to select one from value added courses and one from add-on courses and one from SWAYAM/MOOC platform if the student desires. The fee for this course work will be prescribed by the Controller of Examinations in concurrence with the authorities of Periyar University. Separate certificate will be issued and these extra credits will be included in the Academic Bank of Credit (ABC) portal of the candidate.

Examinations

Examinations are conducted in semester pattern. The examination for the Semester I&III will be held in November/December and that for the Semester II & IV will be in the month of April/May in every academic year.

Candidate failing in any subject (both theory and practical) will be permitted to appear for such failed subjects in the same syllabus structure at subsequent examinations within next 5 years. Failing which, the candidate has to complete the course in the present existing syllabus structure.

Scheme for Evaluation and Attainment Rubrics

Evaluation will be done on a continuous basis and will be evaluated four times during the course work. The first evaluation will be in the 7th week, the second in the 11th week, third in the 16th week and the end – semester examination in the 19th week. Evaluation may be by objective type questions, short answers, essays or a combination of these, but the end semester examination is a University theory examination with prescribed question paper pattern.

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Attainment Rubrics for Theory Courses

Internal (Max. Marks - 25)

S.No.	Approaches	Marks
1	Internal tests (Best two tests out of 3)	10
2	Attendance	5
3	Seminar	5
4	Assignment	5
Total		25

External (Max. Marks - 75)

Section	Approaches	Mark Pattern	K Level	CO Coverage
A	Objective Type (Answer all questions)	20X1 = 20 (Multiple Choice Questions)	✓	✓
B	Descriptive Type (100 to 200 words) (Answer any three out of five questions)	3X5 = 15 (Analytical type questions)	✓	✓
C	Essay Type (500 to 1000 words) (Answer all questions)	5X8 = 40 (Essay type questions)	✓	✓

Attainment Rubrics for Lab Courses

Internal (Max. Marks-40)

S.No.	Approaches	Marks
1	Practical tests (Best two tests out of 3)	30
2	Attendance	5
3	Record Note Book	5
Total		40

External (Max. Marks - 60)

Section	Approaches	Mark Pattern	K Level	CO Coverage
A	Major practical	1X20 = 20	✓	✓
B	Minor practical	1X10 = 10	✓	✓
C	Spotters	4X5 = 20	✓	✓
D	Viva-voce & Record Note Book	10	✓	✓
Total		60		

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Attainment Rubrics for Research

Internal (Max. Marks - 100)

S.No.	Approaches	Marks
1	Manual involvements in experiments	30
2	Attendance	10
3	Submission of Dissertation	60
Total		100

External (Viva Voce) (Max. Marks - 100)

S.No.	Approaches	Marks
1	Viva Voce- Internal Examiner	50
2	Viva Voce- External Examiner	50
Total		100

Grading System

Evaluation of performance of students is based on ten-point scale grading system as given below.

Ten Point Scale			
Grade of Marks	Grade points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-I
(For the students admitted in the academic year 2023-2024 onwards)

BIOCHEMISTRY

Core Paper-01

Paper Code: 23UPBMS1C01

Total Contact Hours: 108

Credits: 5

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	To provide knowledge on the properties of water, acids, bases, pH and biological buffers.	
2.	To learn the concept of bioenergetics and mitochondrial respiratory chain reactions	
3.	To know the chemistry of macromolecules, functions, metabolic pathways and their control	
4.	To know the functions of biomolecules.	
Course I	:	Core-01
Course title	:	BIOCHEMISTRY
Credits	:	5
Pre-requisite:		
Students should know the biomolecules formation, metabolism, diseases and medicine		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Comprehend the structure and importance of water and physiological buffer systems.	K1 & K2
2.	Describe principle of bioenergetics, exergonic and	K2 & K4

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	endergonic reactions.	
3.	Elucidate the mechanism of electron transport chain and ATP generation in living cells.	K3 & K5
4.	Illustrate the chemistry, properties and biological functions of macromolecules including carbohydrates, proteins, nucleic acids and lipids.	K4 & K6
5.	Describe the biosynthesis (anabolism) of glucose, glycogen, amino acids and nucleic acids and lipids.	K5 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Atoms: Chemical Composition of living matter. Biological importance of water. Buffers and its Physiological properties. Carbohydrates: Classification, structure and function. Carbohydrate metabolism: Anabolism – Glycogenesis and Gluconeogenesis. Catabolism – Glycolysis, Kreb’s cycle and Glycogenolysis. Electron transport chain. Metabolic disorder: Diabetes and their biomedical significance.
II	Amino acids: Structure and classification of amino acids. Essential amino acids and Non-essential amino acids, glycogenic and ketogenic amino acids. Proteins: Classification of proteins. Primary, Secondary, Tertiary and Quaternary structure of protein. Metabolism of amino acids- glucogenic and ketogenic amino acids. Transamination, deamination and decarboxylation reactions. Urea cycle and its regulation.
III	Lipids: Structure and Classification of Lipids. Types of fatty acid oxidation: Beta, alpha, omega and peroxysomal oxidation. Ketosis, biosynthesis of fatty acids. Triglycerides and Cholesterol: Structure & function, Cholesterol biosynthesis. Biomedical importance of lipids in Obesity.
IV	Nucleic acids: Structure and functions of DNA and RNA. Synthesis and degradation of purine and pyrimidine (De novo and salvage pathways). Syndromes associated with nucleic acid metabolism: Aicardi-Goutières syndrome (AGS), Lesch-Nyhan syndrome and GOUT Disease.
V	Hormones – Peptide and Non-peptide mammalian hormones, receptors, feedback loops, signaling cascades, secondary messengers as hormones, steroid hormone receptor and gene action. Insect pheromones. The biochemistry of Learning, Memory and Thinking.

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Reading list	
1	Murray, R. K., Granner, D. K., Mayes, P. A., Rodwell, V. W. (2017) Harper's Biochemistry. Prentice Hall International Inc.
2	Lehninger, A. L., Nelson, D. K., and Cox, M. M. (2015) Principles of Biochemistry. CBS Publishers and distributors, New Delhi.
Recommended texts	
1.	Stryer, L. (2016) Biochemistry. W. H. Freeman and Company, New York.
2.	Voet.D. Judith, G. Voet, Charlotte W. Pratt. (2017) Fundamentals of Biochemistry, John Wiley& Sons Inc. New York.
3.	Satyanarayanan, U (2015). Essentials of Biochemistry, Uppala Author – Publisher Interlinks, Vijayawada.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-I
(For the students admitted in the academic year 2023-2024 onwards)

CELL AND MOLECULAR BIOLOGY

Core Paper-02

Paper Code: 23UPBMS1C02

Total Contact Hours: 108

Credits: 5

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	To explain the concept of Chemical Basis of Life	
2.	Describe the internal and external structural organization of cell and its organelles	
3.	To enlighten the functional role of the cellular organelles	
4.	To know the functions of biomolecules.	
Course I	:	Core-02
Course title	:	CELL AND MOLECULAR BIOLOGY
Credits	:	5
Pre-requisite:		
Students should know fundamentals of cells, structure and function and signaling pathways.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Understand the cell as a basic unit of life. Understand the chemical basis of life.	K1 & K2
2.	Understand about different types of cells.	K2 & K4
3.	Understand the components aiding in cell –cell communication.	K3 & K5
4.	Understand the structural organization of genetic materials in prokaryotic/ eukaryotic	K4 & K6

M.Sc., Biomedical Science, Department of Zoology, Periyar University

5.	Understand the detailed structural organization of prokaryotic and eukaryotic cells.	K5 & K6
----	--	--------------------

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Discovery of cell: Cell theory, Basic structure of prokaryotic and eukaryotic cell, Cell Cycle, and regulations. Cell division: mitosis- Stages and Significance. Meiosis -Stages and their significance. Significance of 2020 Nobel Prize for Discovery of Hepatitis C Virus and 2021 Nobel Prize for Discoveries of membrane receptor for temperature and touch.
II	Ultra-structure and functions of Plasma membrane – Fluid Mosaic model theory- Transport mechanism- Exocytosis, Endocytosis, Simple Diffusion. Active Transport Mechanism: Structural Components of ion channels and their functions – ATPase Dependent Na/K ion transport, Ca ²⁺ Transport mechanism in Insulin Secretion and Neurotransmitter secretion. Micro bodies peroxisomes and Glyoxysome.
III	Nucleus: ultrastructure of nuclear membrane, Nucleolus, Nucleoplasm and Chromatin fibers, Microtubules, microfilaments – Cilia and Flagella, Ribosome and Golgi bodies, Lysosome, Endoplasmic reticulum. Mitochondria. Cell Signaling: Types, organization of cell signals and their receptors. Functions of Ion channel coupled receptors – secondary messengers. Amplifiers, Integrators. 2016 Nobel Prize for discovery of Autophagy and 2013 Nobel Prize for the discoveries of machinery regulating Vesicle traffic, a major transport system in our cell.
IV	The Exosome: Exosome Research Importance, Extracellular Vesicles – Structure and Composition, Mechanism of formation of Exosomes in cells, Circulation of Exosomes, Heterogenicity of Exosomes, Signal Transduction. Immune response and exosomes. Current scenario of Circulating DNA Research. Mechanism of cell aging and senescence. Comparison of Cell death: Necrotic and apoptotic cells.
V	DNA replication – semi conservative and rolling circle models. Enzymes involved in DNA Replication: types and their functions. Transcription and Translation in eukaryotes: RNA polymerase – types, properties, and functions–Transcription process in Eukaryotes. DNA to Nascent RNA and to mature RNA mediated by splicing mechanism. Protein Synthesis: mRNA serve as Template, Interaction of mRNA and rRNA, mRNA and RNA Polymerase, Participation of tRNAs in

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	Translation and post translational modifications and their biological importance.
Reading list	
<ol style="list-style-type: none"> 1. Cooper, G.M. (2019). The Cell – Molecular Biological Approaches. ASM Press, Washington. 2. Lodish H, Kaiser CA, Brasher A, Amon A, Berk A, Kreger M, Ploegh H and Scott MP (2014) Molecular Cell Biology, 7th edition, Garland Publishing, Inc. New York. 	
Recommended texts	
<ol style="list-style-type: none"> 1. Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P (2018) Essential Cell Biology. Garland Science, New York 2. De Robertis EDP and De Robertis EMF (2018) Cell and Molecular Biology. Lippincott Williams and Wilkins, USA. 3. Gupta PK (2019) Cell and Molecular Biology. Rastogi Publications, Meerut. 4. Karp G (2017) Cell and Molecular Biology: Concepts and Experiments. 6th edition, John Wiley and Sons Ltd. New York. 5. Lewin B (2020) Genes XIII Oxford University Press, Oxford. 6. Walker JM and Gingold EB (2013) Molecular Biology and Biotechnology. Panima University Press, Oxford Publishing Co., New Delhi. 7. Thorpe NO (2000) Cell Biology, John Wiley and Sons, New York. 8. Turner PC McLennan AG Bates AD and White MRH (2007) Instant Notes Molecular Biology. Viva Books Pvt. Ltd., New Delhi. 9. Thomas Pollard, William Earnshaw, Jennifer Lippincott Schwartz, Graham Johnson, (2017) Cell Biology, 3rd Edition, Elsevier Publishing, USA, 	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-I
(For the students admitted in the academic year 2023-2024 onwards)

MEDICAL GENETICS

Core Paper-03

Paper Code: 23UPBMS1C03

Total Contact Hours: 72

Credits: 4

Weekly Contact Hours: 4

Course Objectives:		
The main objectives of this course are:		
5.	To gain knowledge on the laws and patterns of genetic inheritance.	
6.	Understanding the methods involved in genetic analysis.	
7.	To gain insights on genetic abnormalities and their impact on diseases	
Course I	:	Core-03
Course title	:	MEDICAL GENETICS
Credits	:	3
Pre-requisite:		
Students should know the taxonomical classification of invertebrate animals in relation to their functional morphology.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
6.	Comprehend the importance of Genetics.	K1 & K2
7.	Describe the principles of inheritance.	K2 & K4
8.	Illustrate the genetic abnormalities associated with diseases	K3 & K5
9.	Describe various methods of evaluating genetic diseases.	K4 & K6

M.Sc., Biomedical Science, Department of Zoology, Periyar University

10.	Know the therapeutic strategies for genetic disease and elucidate the mechanism underlying mutations	K5 & K6
-----	--	--------------------

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Human Genetics - Principles - History and Impact of Genetics in Medicine - Gregor Mendel and the Laws of Inheritance - The Origins of Medical Genetics - Types of Genetic Disorders (single gene disorders, Chromosomal disorders, Polygenic disorders, Somatic cell genetics, mitochondrial disorders) - The Human Genome Project. Human Chromosomes - Cell Division- Mitosis, Meiosis, Gametogenesis - Chromosome Abnormalities- Numerical, Structural and Mosaicism - Patterns of Inheritance - Mendelian Inheritance- Autosomal dominant, Autosomal recessive, Sex linked recessive and dominant - Genomic Imprinting. Mitochondrial Inheritance - Polygenic and Multifactorial Inheritance. Polygenic Inheritance - Identifying Genes that Cause Multifactorial Disorders- Linkage analysis, Association studies, GWAS studies.
II	Molecular Genetics & Cytogenetics: DNA sequence polymorphisms- SNPs, VNTRs, Minisatellites, Microsatellites. Mapping and Identifying Genes for Monogenic Disorders - Position-Independent Identification of Human Disease Genes - Positional Cloning. The Human Genome Project and its Applications - Epigenetics - Microarray in research and clinical practices Cytogenetics - Methods of chromosome analysis- Karyotyping and chromosomal banding - Fluorescent In-Situ Hybridization - Comparative Genomic Hybridization - Chromosome Nomenclature - Prenatal cytogenetics - Cancer cytogenetics.
III	Population And Mathematical Genetics -Hardy-Weinberg Principle and its Applications - Factors that alter gene frequency- non-random mating, small populations, selection, Mutations,, Migration and gene flow. Consanguinity and its consequences - Genetic Polymorphism - Segregation Analysis - Genetic Linkage - Risk Calculation - Probability Theory - Use of Linked Markers -Bayesâ Theorem and Prenatal Screening - Empiric Risks
IV	Genetics in Medicine: Hemoglobin and the Hemoglobinopathies - Disorders of Hemoglobin – alpha, beta and gamma - Clinical Variation of the Hemoglobinopathies - Antenatal and Newborn Hemoglobinopathy

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	Screening. Disorders of coagulation and bleeding - Factor VIII - Factor IX - Afibrinogenemia .Inborn Errors of Metabolism - Disorders of Amino Acid and Branched-Chain Amino Acid Metabolism - Urea Cycle Disorders - Disorders of Carbohydrate Metabolism -Disorders of Steroid Metabolism - Disorders of Lipid Metabolism - Disorders Affecting Mitochondrial Function. Prenatal Diagnosis of Inborn Errors of Metabolism
V	Clinical Genetics: Epigenetics and Cancer - Diabetes - Crohn Disease -Hypertension - Coronary Artery Disease - Schizophrenia - Alzheimer Disease - Hemochromatosis - Venous Thrombosis - Age-Related Macular Degeneration. Recurrent miscarriage - Xeroderma Pigmentosa - X chromosome inactivation - X-linked mental retardation and Fragile X 3 Single-Gene Disorders -Huntington Disease - Hemophilia . Preimplantation Genetic Diagnosis - Non-Invasive Prenatal Diagnosis. Stem Cell Therapy & Ethical and Legal Issues in Medical Genetics.
Reading list	
<ol style="list-style-type: none">1. Brooker, R.J. (2017) Genetics: analysis and principles, 6th edition. New York, NY: McGraw-Hill Education2. Hartwell, L. et al (2017) Genetics: from genes to genomes, 6th edition. New York, NY: McGraw-Hill Education3. Emery's Elements of Medical Genetics 12th edition, Peter Turnpeeny Sian Ellard, Elsevier publications.	
Recommended texts	
<ol style="list-style-type: none">4. Alberts, B. et al (2015) Molecular biology of the cell 6th edition. New York, NY: Garland Science5. Lodish, H. et al (2016) Molecular Cell Biology 8th edition. W.H.Freeman6. Alberts, B. (2014) Essential Cell Biology 4th edition. New York, NY: Garland Science7. Hardin, J., Bertoni, G., Kleinsmith, L.J., Becker, W.M. (2012) Becker's world of the cell 8th edition. Boston, MA: Benjamin Cummings	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

8. Ridley, M. (2004) Evolution 3rd Edition. Malden, MA: Blackwell

9. Steams, S.C. & Hoekstra, R.F. (2005) Evolution: an Introduction, 2nd edition. Oxford: Oxford University Press.

10. Practical Biology • Jones, A.M., Reed, R. & Weyers, J.D.B. (2016) Practical Skills in Biology, 6th edition. Harlow: Pearson Education

11. Physiology • Moyes, C.D. & Schulte, P.M. (2016) Principles of animal physiology, 3rd edition. Toronto: Pearson

12. Boron, WF & Boulpaep E.L. (2012) Medical Physiology, 2nd Edition Elsevier Saunders

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

M.Sc., Biomedical Science, Department of Zoology, Periyar University

PERIYAR UNIVERSITY SALEM -636 011

Department of Zoology

M.Sc., Biomedical Science Programme-SEMESTER-I

(For the students admitted in the academic year 2023-2024 onwards)

LAB COURSE -I

(Biochemistry, Cell and Molecular Biology, Medical Genetics)

Lab CourseS-01

Paper Code: 23UPBMS1L01

Total Contact Hours: 108

Credits: 3

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	To impart knowledge of basic techniques such as genomic DNA and plasmid DNA isolation	
2.	To gain hands on experience in gel-electrophoresis techniques.	
3.	To develop & train students with the knowledge of PCR& blotting techniques	
Course I	:	Lab Course-01
Course title	:	LAB COURSE -I (Biochemistry, Cell and Molecular Biology, Medical Genetics)
Credits	:	3
Pre-requisite:		
Students should experiment to measure and identify the molecular changes via various techniques.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Know the basic concept and principles of molecular biology techniques	K1 & K2

M.Sc., Biomedical Science, Department of Zoology, Periyar University

2.	Gain hands on experience in extraction of genomic & plasmid DNA	K2 & K4
3.	Gain the practical knowledge of agarose gel electrophoresis	K3 & K5
4.	Demonstrate practical skills in different molecular biology laboratory equipment's and their handling	K4 & K6
5.	Enable them to begin a career in academic research or R&D in Biotechnological& Pharmaceutical Industries.	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Units	
I	<p>Biochemistry</p> <ol style="list-style-type: none"> 1. Determination of glucose level in Blood 2. Effect of Temperature on salivary amylase activity 3. Identification of amino acids by paper chromatography 4. Spotters: Diabetes, Lesch-Nyhan syndrome and GOUT Disease 5. Molecular Weight Determination using SDS-PAGE
II	<p>Cell & Molecular Biology</p> <ol style="list-style-type: none"> 1. Micrometry for cell measurement 2. Identification of different types of cells in blood 3. Differential leukocyte count using Leishman stain 4. Observation of Mitosis (onion root tip) 5. Identification of multinucleated cells in cancer biopsy 6. Cells of vital organs spotters (Slides: Kidney, Liver, Spleen, Stomach, muscles, lung and colon)
III	<p>Medical Genetics</p> <ol style="list-style-type: none"> 1. Survey of Genetic Disorders in an around Periyar University Hospitals 2. Survey of Lifestyle diseases in Salem (Data Collection at Govt. Hospital) 3. Observation of Mendelian traits Among Student Volunteers 4. Identification of Human Syndromes – Voucher Specimen 5. Study on polygenic inheritance – Voucher Specimen 6. Pedigree Analysis of Genetic Disorder (Hemophilia and Night Blindness) 7. Genetic Counseling methods (Among Student Volunteers) 8. DNA Isolation and Agarose Gel Electrophoresis

M.Sc., Biomedical Science, Department of Zoology, Periyar University

9. PCR based Diagnosis of Pathogenic/ infectious diseases.

REFERENCE BOOKS:

1. Plumer HT (2012) Practical : Biochemistry , Wiley Publication, India
2. Borah D (2012) Biotechnology Lab Practices, Global Academic Publisher, India.
3. Kannan S, Krishnan M, Thirumurugan R and Achiraman S (2012) Methods in Molecular Biology, UVN Publishers, India.
4. Kannan S and N. Kayalvizhi, 2022. Cell and Molecular Biology – A Practical Approach.
5. Lal SS (2009) Practical Zoology, Rastogi Publications, New Delhi.

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-I
(For the students admitted in the academic year 2023-2024 onwards)

MEDICAL MICROBIOLOGY

Elective Course-01

Paper Code: 23UPBMS1E01

Total Contact Hours: 72

Credits: 3

Weekly Contact Hours: 4

Course Objectives:		
The main objectives of this course are:		
1.	To acquire depth knowledge in medically important bacteria.	
2.	To gain information about the bacterial infection occurs in digestive, reproductive, urinary system.	
3.	To get information about the fungi and their toxins	
Course I	:	Elective Course -01
Course title	:	Medical Microbiology
Credits	:	3
Pre-requisite:		
Students should know the important of microbes and their related diseases		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Understanding the basic knowledge on medically important microbes.	K1 & K2
2.	Acquire the information on culture collection, transportation and quality control.	K2 & K4
3.	Get a clear idea on Enterobacetriaceae family and its pathogenicity and acquire information on mycology, mycotoxins and medically important yeasts.	K3 & K5
4.	This study helps in understanding the pathogenicity of the microbes in nervous system.	K4 & K6

M.Sc., Biomedical Science, Department of Zoology, Periyar University

5.	Get information on Parasites and its pathogenicity and better understanding of laboratory techniques used in parasitology.	K5 & K6
----	--	--------------------

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	General properties of medically important bacteria. Recommendation for collection, transport of specimens, Isolation of bacteria from clinical specimens- Primary media for isolation and their quality control – Antibiotic sensitivity disc, testing procedure and their quality control.
II	Bacteriology: Digestive system – Escherichia coli, Salmonella, Shigella and Vibrio. Urinary system – Leptospira sp., and proteus and Respiratory system – Mycobacterium tuberculosis
III	Bacteriology: Reproductive system – Neisseria and Treponema and Nervous system – Clostridium tetani
IV	Virology: General properties of viruses – Detection of viruses and antigens in clinical specimens – Serological diagnosis of virus infections. Hepatitis, Pox, Oncogenic and Human Immuno Deficiency (HIV) viruses. Viral vaccines – their preparation and Immunization schedules.
V	Mycology and Parasitology: Introduction to Medical Mycology – morphology of fungi. Detection and recovery of fungi from clinical specimens. Yeast of medical importance – Candida and Cryptococcus. Introduction to Medical Parasitology – Protozoan – Entamoeba – Plasmodium, Trypanosoma. Laboratory techniques in parasitology- Examination of faeces for ova and cysts

Reading list

1. Prescott, L.M., J.P. Harley and D.A.Klein.(1993). Microbiology.2nd edition. W.M.C - Brown publishers.
2. David Greenwood, Richard B Slack and John F. (2019). Medical Microbiology – Peutherer.Chirchill Livingstone (London) 16th edition.
3. Jawetz., E. J.L. Melnic and E.A. Adelberg (2000). Review of Medical Microbiology. 19th edition. Lange medical publications. U.S.A.
4. Ananthanarayan R. and C.K. Jeyaram Panikar.(1994). Text book of Microbiology. Orient Longman

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

M.Sc., Biomedical Science, Department of Zoology, Periyar University

PERIYAR UNIVERSITY SALEM -636 011

Department of Zoology

M.Sc., Biomedical Science Programme-SEMESTER-I

(For the students admitted in the academic year 2023-2024 onwards)

BIOSAFETY AND BIOETHICS

Elective Course-02

Paper Code: 23UPBMS1E02

Total Contact Hours: 72

Credits: 3

Weekly Contact Hours: 4

Course Objectives:		
The main objectives of this course are:		
1.	To introduce the various aspects of biosafety and levels of biosafety in laboratory.	
2.	To study principles of bioethics and its guidelines.	
3.	To understand Good manufacturing Practice (GMP) and Good lab practices (GLP) and enable students to understand Biosafety assessment of pharmaceutical products such as drugs/vaccines	
Course I	:	Elective Course -02
Course title	:	Biosafety and Bioethics
Credits	:	3
Pre-requisite:		
Students should know the significance of bioethics and biosafety		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Understand the basic concepts in the laboratory biosafety.	K1 & K2
2.	Analyze the basic principles of bioethics and its importance in biological, biomedical, health care research.	K2 & K4

M.Sc., Biomedical Science, Department of Zoology, Periyar University

3.	Gain knowledge about biosafety regulations and bioethics in the context of modern biotechnology microbes.	K3 & K5
----	---	--------------------

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Biosafety: Introduction - Laboratory associated infections and other hazards, Introduction to Biological Safety Cabinets-Assessment of biological hazards and Biological Containment- Good manufacturing Practice and Good lab practices (GMP and GLP)
II	Bioethics: Principles of bioethics- Social and cultural issues of Bioethics--Animal ethics; Guidelines for use of lab animals - Licensing of animal house -IAEC & CPCSEA- Ethical concerns of gene cloning- Ethical clearance norms for conducting studies on human subjects, NECRBHR, ICMR- Ethical implications of human genome project-Ethical issues in Human Cloning and stem cell research - Biopiracy
III	Regulatory framework of Biosafety: Biosafety guidelines and regulations (National and International) for rDNA and other biological researches. Definition of GMOs & LMOs - GM Labeling-Ecological safety assessment of GMO's (Eg. Bt cotton) and mixing up with the gene-pool- Bioterrorism and convention on biological weapons- Cartagena protocol
IV	Pharma and Medical Sector: Biosafety assessment of pharmaceutical products such as drugs/vaccines etc. Biosafety issues in Clinical Trials.
V	Ethical concerns related to prenatal diagnosis, Gene therapy, Organ transplantation, Xenotransplantation, Ethics in patient care, Informed consent
References	
<ol style="list-style-type: none"> 1. Fleming, D.A., Hunt, D.L., (2000). Biological safety Principles and practices (3rd Ed).ASM Press, Washington. 2. Sateesh MK (2010) Bioethics and Biosafety, I. K. International Pvt Ltd. 3. Sree Krishna V (2007) Bioethics and Biosafety in Biotechnology, New age international publishers 4. Thomas, J.A., Fuch, R.L. (2002). Biotechnology and Safety Assessment (3rd 	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Ed). Academic Press

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M – Medium; L-Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-II
 (For the students admitted in the academic year 2023-2024 onwards)

HUMAN ANATOMY

Core Paper-04

Paper Code: 23UPBMS1C04

Total Contact Hours: 108

Credits: 5

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	To learn the gross morphology, structure of various organs of the human body.	
2.	To describe the various homeostatic mechanisms and their imbalances.	
3.	To understand the various tissues and organs of different systems of human body	
4.	To learn special senses and their tests.	
Course I	:	Core-04
Course title	:	HUMAN ANATOMY
Credits	:	5
Pre-requisite:		
Students should know the anatomical terms and structure of different organs of each system		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Introduction of anatomical terms and brief outline of various systems of the body.	K1 & K2
2.	Differentiate the levels of organization in the human body and the characteristics of each	K2 & K4
3.	Understand the homeostatic mechanisms and their imbalances	K3 & K5
4.	Regional anatomy of gastrointestinal, respiratory Endocrine, excretory systems.	K4 & K6
5.	Explain the Innovations and Breakthroughs in Human Anatomy	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Units	
I	An Overview of Human Anatomy: Definition and scope of anatomy, levels of structural organization and human body systems, basic life processes, homeostasis, basic anatomical terminology. Tissue Level of Organization: Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.
II	Integumentary System: Structure and functions of skin. Skeletal System: Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system. Organization of skeletal muscle, Types and structure of muscles. Joints and bones: Structural and functional classification, types of joints movements and its articulation. Dental anatomy and formula of human.
III	Digestive System: Anatomy of human digestive system. Blood: Composition and Function of blood and its components: WBC, RBC, platelets. Hematopoiesis, Hemoglobin structure and function. Hemostasis and blood coagulation mechanism, blood groups and blood bank. An overview of lymphoid tissues and Immune System.
IV	Anatomy of Lungs: The Respiratory System-Organs and Structures of the Respiratory System, Lungs – Ultra structure of human lung. Nervous system: Neuro anatomy of peripheral nervous system: Structure of sympathetic and parasympathetic nervous system. Sensory organs: Structure and functions of eye, ear, nose and tongue and their anatomical disorders. Muscular System: Types of muscles, Ultra structure, Biochemical composition of muscles and muscle fibres. Anatomy of neuromuscular system and neuromuscular disorders.
V	Gross Anatomy of Urinary system: Gross Anatomy of Urine tract. Gross Anatomy of the Kidney: Microscopic Anatomy of the Kidney, Physiology of Urine Formation, Tubular reabsorption, regulation of renal blood flow, endocrine regulation of Kidney function. The Urinary system and homeostasis. Reproductive system: Anatomical structure of reproductive organs.
Reading Book list	
1. Cary A. Thibodeau and Kevin T. Patton Anthony's Text Book of Anatomy & Physiology (7th Edition), Mosby Publications	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

2. Inderbir singh, Human Anatomy, Jaypee Brothers Medical Publishers (P) Ltd.
3. Gray, Henry (1918). Anatomy of the Human Body. Philadelphia: Lea & Febiger

Recommended texts

1. Gerard, T. J., & Bryan, D. (2015). Anatomy & physiology. Indian edition, Wiley India Pvt. Ltd., New Delhi, 603-623.
2. Martini, F. H., Nath, J. L. & Bartholomew, E. F. (2015). Fundamentals of Anatomy and Physiology. 2001. Pentice Hall: New Jersey, 538-557.
3. VanPutte, C. (2016). Seeley's anatomy & physiology. McGraw-Hill Higher Education

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

M.Sc., Biomedical Science, Department of Zoology, Periyar University

PERIYAR UNIVERSITY SALEM -636 011

Department of Zoology

M.Sc., Biomedical Science Programme-SEMESTER-II

(For the students admitted in the academic year 2023-2024 onwards)

HUMAN PHYSIOLOGY

Core Paper-05

Paper Code: 23UPBMS1C05

Total Contact Hours: 108

Credits: 5

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	To understand the function of major organ systems and its physiological relationship with each other.	
2.	Explain the functions of various organs of the human body.	
3.	To enable to find out the Nobel Prize winners in the concern subject.	
4.	Appreciate coordinated working pattern of different organs of each system.	
Course I	:	Core-05
Course title	:	HUMAN PHYSIOLOGY
Credits	:	5
Pre-requisite:		
Students should know the physiological relationship and working pattern of different organs of each system.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Identify various organs of different systems of human body.	K1 & K2
2.	Explain the interaction of organ system for the maintenance of homeostasis	K2 & K4
3.	Acquire knowledge about contribution of each organ system to the maintenance of homeostasis.	K3 & K5
4.	Understand the physiological processes accurately with relevant scientific terminology and nomenclature leading to develop more consciousness towards a healthy body.	K4 & K6
5.	Explain the innovations and breakthroughs in human physiology	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Units	
I	Membrane Physiology, Nerve and Muscle: Membrane potentials and action potentials & Excitation and Contraction of muscles (Molecular mechanisms of muscle contraction). Blood Physiology: Hemostasis, Blood cells, Blood Clotting & Regulation of Blood pH. Blood groups, transfusion
II	Cardio-vascular Physiology: Physiology of cardiac muscle, Rhythmical excitation of heart, Regulation of heart pumping, Cardiac cycle, Cardiac output and Venous Return, Microcirculation, Capillary fluid exchange. Circulatory regulation: Nervous, humoral and chemical regulation of circulation. Cardiac abnormalities: Normal electrocardiogram, Cardiac Arrhythmias, Heart sounds, Dynamics of valvular and congenital heart defects, Cardiac failure and circulatory shock..
III	Respiratory Physiology: Pulmonary ventilation: Mechanisms of pulmonary ventilation, Pulmonary volumes and capacities, Alveolar ventilation, Functions of respiratory passageways. External & Internal Respiration: Principle of Gas exchange, Diffusion of gases through respiratory membrane, Transport of O ₂ and CO ₂ in blood and body fluids. Bohr effect, Chloride Shift, Haldane effect. Regulation of respiration: Respiratory Control Center, Peripheral chemoreceptor system, Nervous and chemical regulation of respiration.
IV	Gastrointestinal Physiology: General principles of gastrointestinal function: Ingestion of food, Motility, Nervous control, Transport and mixing of food in the alimentary tract. Secretory functions of alimentary tract: Secretion of saliva, Gastric secretion, Pancreatic Secretion, Bile secretion, Secretions of small and large intestine. Digestion and absorption in gastrointestinal tract: Digestion of various foods, Absorption in small intestine.
V	Endocrine Physiology & Hormones: General Characteristic and classification of hormone. Synthesis, secretion, transport, metabolism and mechanism of action of Hypothalamus, Pituitary, Thyroid, Parathyroid, Adrenal, Pancreas glands. Reproductive Physiology: Structure and function of reproductive organs, hormones of testes and ovary, hormonal regulation of ovulation, fertilization, implantation, gestation, parturition and lactation, oogenesis, spermatogenesis.
Reading Book list	
1. Guyton and Hall .Textbook of Medical Physiology. Twelfth Edition Anatomy and Physiology for Nurses, Jaypee Brothers Medical Publishers (P) Ltd.	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Recommended texts

1. Robert M. Berne and Matthew N. Levy Principles of Human Physiology (Third Edition)Mosby Publications
2. Cary A. Thibodeau and Kevin T. Patton Anthony's Text Book of Anatomy &Physiology (7th Edition), Mosby Publications
3. Inderbir singh,Human Anatomy, Jaypee Brothers Medical Publishers (P) Ltd.
4. Gray, Henry (1918). Anatomy of the Human Body. Philadelphia: Lea & Febiger,
5. Hall. J.E. Guyton and Hall (2011) Textbook of Medical Physiology. 12th ed. Saunders, Elsevier Inc.

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

LAB COURSE -II

(Human Anatomy and Human Physiology)

Lab Course -02

Paper Code: 23UPBMS1L02

Total Contact Hours: 108

Credits: 4

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	Theoretical principles of each human anatomy should be supported and clarified using models. Identifying information, a demonstration, and a spotter's identification.	
2.	Blood and other bodily fluids for physiological analysis.	
3.	A variety of spotters related to physiology should be seen and identified.	
Course I	:	Lab Course-02
Course title	:	LAB COURSE -II (Human Anatomy and Human Physiology)
Credits	:	4
Pre-requisite:		
Students should substantiate and clarify the theoretical concepts of each human anatomy through models Identification, demonstration and spotter's identification.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Identify and locate anatomical terms of human body parts. techniques	K1 & K2
2.	Understand the components of various organ systems.	K2 & K4
3.	Examine blood group and Rh factor determination.	K3 & K5
4.	Analyse pulse rate and blood pressure measurement. Measure complete blood count (CBC).	K4 & K6
5.	Perform various haematological experiments like, blood smear preparation, haemoglobin estimation and bleeding/clotting time determination.	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Units	
I	Human Anatomy Human Anatomy Models Identification and Demonstration in Rat as voucher specimen <ol style="list-style-type: none">1. Skeletal system2. Digestive system3. Reproductive system4. Nervous system (Brain)5. Sensory system (Eye & Ear)6. Circulatory system (Heart)7. Renal system8. Respiratory system
II	Human Physiology Hematology <ol style="list-style-type: none">1. To determine the Total Leukocyte Count (TLC)/ cubic millimeter of blood.2. To prepare a 'Stained blood smear to identify the different leukocytes in the blood smear and to do a Differential Leukocyte Count (DLC)3. To determine the Total RBC Counts /cubic millimeter of blood5. To determine the Bleeding Time by Duke Method.6. To determine the Clotting Time by capillary Tube Method.7. To determine the Osmotic Fragility of a given sample of blood8. To estimate the Total Hemoglobin in human blood (Sahl's method)9. To perform the Pulmonary Function Test10. To perform the Cardiac Efficiency Test11. To determine the Blood Pressure
	Spotters: Skull, Brain, Teeth, Lungs, Heart, Bones, Spinal cord, Kidney, Pectoral and pelvic bones and joints. Histology of nerve, muscle, blood, cardiac and reproductive cells.
REFERENCE BOOKS: <ol style="list-style-type: none">1. Amitrano, R., & Tortora, G. (2012). Update: anatomy & physiology laboratory manual. Cengage Learning. S.R. Kale & R.R.Kale, Practical Human Anatomy and Physiology, NiraliPrakashan Publications.2. S.K. Pandey, VarunDutt Sharma (2014), Human Anatomy and Physiology: Practical Notebook For 1stYear Diploma in Pharmacy, CBS Publishers & Distributors Pvt. Ltd. (2014)3. G.K.Pal & P. Pal. (2006). Textbook of Practical Physiology. 2ndEdn. Orient	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Blackswan. <http://www.bartleby.com/107/>

4. Pal, G. K., & Pravati, P., (2010). Text Book of Practical Physiology, (3rd edn.).Universities Press (India) Private Limited.

5. Pal, G. K., Pal, P., Nanda. N. & Amudharaj. D. (2015). Atlas of Human Anatomy, (1st ed.). Jordi Vigue. Chambarlen Press.

6. Tortora, G. J., & Derrickson, B. (2014). Anatomy and Physiology-WorkBook. CBS publication.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-II
(For the students admitted in the academic year 2023-2024 onwards)

BIOINSTRUMENTATION AND BIOIMAGING TECHNOLOGY

Elective Course-03

Paper Code: 23UPBMS1E03

Total Contact Hours: 72

Credits: 3

Weekly Contact Hours: 4

Course Objectives:		
The main objectives of this course are:		
1.	To understand the concept of Bioinstrumentations in molecular analysis and bioimaging techniques	
2.	To realize the range of structure of metabolites. Understand the essential principles of ultrasound, X-ray imaging (CT)	
3.	To Acquired knowledge of imaging system theory and their applications	
Course I	:	Elective Course -03
Course title	:	BIOINSTRUMENTATION AND BIOIMAGING TECHNOLOGY
Credits	:	3
Pre-requisite:		
Students should know the important functional methodology of instruments in medical applications.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	To comprehend the many techniques used in the characterisation of biomolecules.	K1 & K2
2.	To create a variety of comprehension techniques for the intricate biological processes.	K2 & K4
3.	Understand the imaging concepts that characterize the quality of imaging techniques	K3 & K5
4.	Acquired knowledge about the principles of image formation, capture and display of ultrasound and X-ray..	K4 & K6

M.Sc., Biomedical Science, Department of Zoology, Periyar University

5.	Understand and describe the mechanisms of tomography, MRI and NMR spectroscopy.	K5 & K6
----	---	--------------------

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	History, scope and advancement in biomedical instrumentation. Scales of biological organization. The needs for biomedical instrumentation: The scientific methods clinical diagnosis, feedback in measurement system. Common medical measurements and their applications. Bioelectronics, biosensor: Principle and applications. Impact of nanotechnology in development of Biomedical instruments.
II	Instrumentation for cardiovascular measurements: The heart and cardiovascular system, blood pressure, characteristics of blood flow, heart sounds. Principle, methods and applications of Electrocardiogram (ECG), plethysmography. Lungs: The physiology of respiratory system, instrumentation for the mechanics of breathing, respiratory therapy equipment. Principle of thermometer and Ultra-sonic measurements.
III	Neuronal sensory measurements-Psychophysiological measurement, Instruments for motor neuron responses, sensory neuron measurements. Equipment for behavioral analysis. Blood: Blood components, blood collection methods cell counts, Haemoglobinometer, Haemocytometer and Histological methods of WBC differential counts.
IV	Principles and applications of confocal microscope, fluorescence microscope, EM- scanning electron microscope(SEM), transmission electron microscope (TEM), Live and dead assay with dyes. Image acquisition: Principle and applications of Electromyography (EMG), Electro-Oculogram (EOG), Electroretinogram (ERG), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET).
V	Biomedical Instrumentation for testing kidney clearance, creatinine, kidney Imaging (Pyelogram). Types of dialysis-Haemodialysis, Peritorial dialysis, and kidney function test. Bone and Joints: Analysis of bone mineral density, stress and strain, strain gage, joint friction and bone position testing. Clinical temperature measurements. Calorimetry for bode heat study. Principle and functions of Goniometer and accelerometer for body movements. Current scenario of Biotechnology and Role of Artificial Intelligence and medical informatics in biomedical sciences.

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Reading list
<ol style="list-style-type: none">1. John G. Webster, 2004. Bioinstrumentation, Johnwiley and sons, Pvt.Ltd. Singapore.2. L Cromwell, F.J.Welbell and E.A. Pfeiffer.1980. Biomedical instrumentation and measurements. Second Edition. PHI publisher, New Jersey, USA.
Recommended texts
<ol style="list-style-type: none">1. Mandeep Singh. 2010. Introduction of Biomedical Instrumentation. PHI Learning Pvt. Ltd, New Delhi2. Drexler, W., & Fujimoto, J. G. (Eds.). (2008). Optical coherence tomography: technology and applications. Springer Science & Business Media.3. Hendee, W. R., & Ritenour, E. R. (2003). Medical imaging physics. John Wiley & Sons.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-II
 (For the students admitted in the academic year 2023-2024 onwards)

STEM CELL BIOLOGY

Elective Course-04

Paper Code: 23UPBMS1E04

Total Contact Hours: 72

Credits: 4

Weekly Contact Hours: 4

Course Objectives:		
The main objectives of this course are:		
1.	Information about stem cells, their traits, and stem cell markers	
2.	Detailed explanation of the characteristics of embryonic, adult, and induced pluripotent stem cells.	
3.	Explains the different kinds, characteristics, and uses of biomaterials.	
Course I	:	Elective Course -04
Course title	:	Stem Cell Biology
Credits	:	3
Pre-requisite:		
Students should know the important and the basics and principles of stem cell technologies		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Comprehend the basics of stem cell biology. Describe the methods for isolation	K1 & K2
2.	To illustrate the properties of stem cells biological processes.	K2 & K4
3.	Describe various applications of stem cells. Know the therapeutic strategies using stem cells	K3 & K5
4.	Elucidate the mechanism underlying stem ness as well as the methods involving isolation of different stem cells.	K4 & K6
5.	Understanding various limitations and challenges..	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Units

M.Sc., Biomedical Science, Department of Zoology, Periyar University

I	Introduction to stem cell biology-Definition, classification and sources of stem cells, Properties- self-renewal, pluripotent and reprogramming, Maintenance of stem cell culture, sub cloning, spontaneous and controlled differentiation of embryonic stem cells, Stem cell niche.
II	Regenerative and Stem cells: Role of stem cells in regeneration Stem cell lineage tracing, early development and embryonic stem cells, Model organisms in stem cell research. Stem cells in neurodegenerative and cardiovascular diseases.
III	Cancer Stem Cell (CSC), cancer stem cells in solid tumors, Cytokines as survival factors in CSCs. Control of CSC migration and invasion. Exploiting CSC differentiation for tumor therapy. Targeting autocrine survival signals in CSCs. Implication of cancer stem cells for therapy. Stem cell for transplant therapy.
IV	Embryonic stem cells (ESC) and haematopoietic stem cells (HSC): definition, isolation and clinical applications (transgenics and bone marrow transplantation (BMT)) BMT for autoimmune diseases.
V	Ethical implications and National policies governing ES cell research for science and the scientist. Ethical issues associated with stem cell biology.

Reading list

1. Stem cells (Bench to Bedside) Ariff Bongso, Eng Hin Lee (Editors)- 2005- scientific publishing Co.
2. Stem cells : Scientific facts and fiction - By Christine L. Mummery, Anja Van de Stolpe, Bernard Roelen, Hans Clevers.
3. Tissue Engineering- Bernhard O, Palsson.

Recommended texts

1. Stem Cell Biology and Gene Therapy. Quesenberry PJ, Stein GS, eds. (£65.00.) Wiley, 1998.
2. Progress in gene therapy, Volume 2, Pioneering stem cell/gene therapy trials, Roger Bertolotti, Keiya Ozawa and H. Kirk Hammond, VSP international science publishers.
3. 5 Human Embryonic Stem Cells: The Practical Handbook by Stephen

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Sullivan and Chad A Cowan

4. J. J. Mao, G. Vunjak-Novakovic et al (Ed): Translational Approaches in Tissue Engineering & Regenerative Medicine 2008, Artech House, INC Publications.
5. Robert Lanza et al. Principles of Tissue Engineering, 3rd Edition. Academic Press; 3 edition (August 21, 2007)
6. Lanza et al. Handbook of Stem Cells, Two-Volume Set: Volume 1- Embryonic Stem Cells; Volume 2-Adult & Fetal Stem Cells (v. 1).Academic Press (September 28, 2004)
7. “Stem cell basics and application” Ed. By K. D. Deb and S. M. Totey, Tata McGraw Hill Pvt. Ltd, 2011. 2. “Hand book of Stem Cells” Edited by RoberLanza, Elsevier, Academic Press, 2011.
8. “Stem Cells Handbook”, Edited by Stewart Sell, Human Press, 2010.
9. Handbook of stem cells, Edited by Robert Lanza. Elsevier academic press.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

PERIYAR UNIVERSITY SALEM -636 011

Department of Zoology

M.Sc., Biomedical Science Programme-SEMESTER-II

(For the students admitted in the academic year 2023-2024 onwards)

ANIMAL CELL CULTURE

Skill Enhancement Course (SEC) - 01

Paper Code: 23UPBMS1S01

Total Contact Hours: 36

Credits: 2

Weekly Contact Hours: 2

Course Objectives:		
The main objectives of this course are:		
1.	To develop an understanding of current techniques used in biotechnology and their applications to animal sciences and the biomedical field.	
2.	To understand basic cell culture and preservation techniques	
3.	To understand the applications of Animal cell culture.	
Course I	:	Skill Enhancement Course (SEC)-01
Course title	:	Animal Cell Culture
Credits	:	2
Pre-requisite:		
Students should know the important and the basics and principles of and applications of animal cell culture		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Acquaint fundamentals of Animal cell culture.	K1 & K2
2.	Utilize skills of cell culture for development of biomolecules of clinical importance	K2 & K4
3.	describe the relevance of cell cycle regulations in reference to cellular metabolism	K3 & K5
4.	Understand the mechanism of cellular cytotoxicity.	K4 & K6
5.	Understanding various limitations and challenges.	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Units	
I	Cell Culture Laboratory Design and Equipments: Guideline for Planning, construction and services to establish cell culture room. Principle, method and applications of Laminar flow, CO ₂ incubator, Centrifuge, Inverted stage microscope and Liquid nitrogen freezers. Biological significance of Washing, packing and sterilization of different materials used in animal cell culture, Aseptic concepts, Maintenance of sterility.
II	Cell Culture Media and Reagents: Types of cell culture media, Ingredients of media and their physiochemical properties. Importance of Balance salt solutions, Antibiotics, growth supplements, Foetal bovine serum, Serum-free media and Trypsin solution.
III	Cell Culture Techniques: History of animal cell culture, Types: Primary culture; Chicken embryo fibroblast culture, Chicken liver and kidney culture. Secondary culture: Trypsinization, Cell separation, Continuous cell lines, Suspension culture, Organ culture etc., Development of cell lines, Characterization and maintenance of cell lines, stem cells, Cryopreservation, importance of Common cell culture contaminants.
IV	Applications of Cell Culture: Application of animal cell culture for in vitro testing of drugs, Testing of toxicity of environmental pollutants in cell culture, Application of cell culture technology in production of human and animal viral vaccines and recombinant proteins.
V	Scale up Technique: Cell culture reactors, Scale-up in suspension, Fluidized bed reactors for suspension culture, Scale-up in monolayers, Multi-surface propagators, Multi-array disks, spirals and tubes, Microencapsulation, Growth monitoring.
Reading list	
1. Culture of Animal Cells(2005) 5th Edition, Freshney Wiley-Liss, 2. Pörtner, R. (2007). Animal Cell Biotechnology: Methods and Protocols. Totowa, NJ: Humana Press.	
Recommended texts	
1. Animal Cell Culture - Practical Approach (2000), 3rd Edition, Ed. John R.W.	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

MastersOxford University Press

2. Animal Cell Culture Techniques. (1998). Ed. Martin ClynesSpringer, Handbook of stem cells, Edited by Robert Lanza. Elsevier academic press.
3. Buchanan, B. B., Gruissem, W., & Jones, R. L. (2015). Biochemistry & Molecular Biology of Plants, Wiley 2002

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

IMMUNOLOGY

Core Paper-06

Paper Code: 23UPBMS1C06

Total Contact Hours: 108

Credits: 5

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	To understand cells and organs of Immunology.	
2.	To study basics of antigen, antibody and MHC molecules.	
3.	To study clinical immunology with respect to various diseases.	
4.	To study various immune-techniques of immunology.	
Course	:	Core-06
Course title	:	IMMUNOLOGY
Credits	:	5
Pre-requisite:		
Students should know the immune-techniques of immunology with respect to various diseases		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Remember the general concepts understand the working of cells and organs of Immunology	K1 & K2
2.	Explain the properties of antigen, antibody and MHC molecules.	K2 & K4
3.	A To ensure understanding about the immunological techniques in the diagnosis of diseases.	K3 & K5
4.	Describe various antigen-antibody reactions and their Significance..	K4 & K6
5.	Evaluate and discuss the clinical aspects of Immunology.	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Units	
I	History of Immunology-Jenner, Pasteur, Metchnikoff, KITASATO – Types of immunity – Innate immunity- organs involved- Acquired Immunity – Cells involved- Hematopoietic stem cells – Cells of immune system, T and B cell activation and maturation, Antigens-The molecular basis of antigen and antibody interactions. Organs of Immunity- Primary- Bone marrow, Bursa- Thymus- Secondary lymphoid Organs- Lymph nodes, MALT-Spleen.
II	Immunoglobulins- General Structure- Types- IgG, IgA, IgM, IgE, IgD- Class switching- Hybridoma technology- Monoclonal antibody production and application. Immunologic messenger molecules- Cytokines, Chemokines, interferons interleukins- Complement system: Classical, Alternate, MBL pathway.
III	Transplantation Immunology- Tissue typing and organ transplantation – MHC gene in human and mouse, MHC class I and class II molecules – Autoimmune diseases: Type-1 Diabetes- Addison’s disease and Graves, disease. Immunostimulation and Immunosuppression and their clinical significance.
IV	Immunity against diseases- HIV- Structure- spread and control- Covid-19- Stages of infection- spread and control measures- quarantine. Molecular interaction between T cell and Corona virus-2 - Covid19 Vaccines and their effectiveness - booster dose. Cancer and Tumour immunology – Nobel Prize 2020 for discovery of Immunotherapy for Cancer – 2019 Nobel Prize for discovery concerns the impact of Hepatitis C virus and Cancer.
V	Techniques in Immunology: Radio Immuno Assay, ELISA, Western Blotting, Immunofluorescence technique, immunohistochemistry. Vaccines– whole organism vaccine, synthetic peptide vaccine, multivalent subunit-anti idotype vaccine, designer vaccine, edible vaccine, DNA vaccine, recombinant vector vaccine; Abzymes, Current scenario of vaccines and vaccination

Reading Book list

1. Abbas,A.K., and A.H.Lichtman (2020) Cellular and molecular immunology, First-South Asia Edition, Elsevier.
2. Delves,P.,S. Martin,D. Burtonand I.M.Roitt, (2017), Roitt’s Essential Immunology, 13thEdition, Wiley–Blackwell publications, USA
3. Murphy,K.M., and Weaver,C (2017) Janeway’s Immunology, 9thedition, W.W.Norton & Company, USA
4. Paul,W.E. (2012) Fundamental Immunology, 7thEdition, Lippincott Williamsand Wilkins, USA
5. Punt.J., Stranford,S., Jones,P., W.A. Owen (2018). Kuby Immunology 8thEdition,W.H. Freeman & Company, NewYork.

M.Sc., Biomedical Science, Department of Zoology, Periyar University

6. Tizard, I.R. (1995) Immunology- An introduction IV Ed. Saunders College Publications, Philadelphia, USA.

Recommended texts

1. Kuby, Judy Owen, Jenni Punt, Sharon Stanford. (2007). Immunology, 8th Edition WH Freeman Publishers.
2. Kuby, Judy Owen, Jenni Punt, Sharon Stanford., (2003). Immunology, WH Freeman Publishers, 5th Edition
3. Tizard, Ian R. (1995). Immunology- An Introduction, 4th edition, Saunders College Publishing, New Delhi.
4. Roitt I. (2017). Essential Immunology, 13th edition, Blackwell Scientific Publications,
5. Abbas, Lichtman, Pillai (2017). Cellular & Molecular Immunology, Pillai. 6th ed. Elsevier publications.
6. Butterworth & Heinemann (1993). Cellular interactions & Immunobiology BIOTOL series.
7. Warren Levinson (2018). Review of Medical Microbiology & Immunology 9th ed. Mac Graw Hill publications.
8. B. Hannigan. (2009). Immunology Viva books Pvt. Ltd.
9. K.R. Joshi, N.O. Osamo (2013). Immunology & Serology. Student edition.

PHARMACOLOGY AND TOXICOLOGY

Core Paper-07

Paper Code: 23UPBMS1C07

Total Contact Hours: 108

Credits: 5

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	The course aims to reinforce students' fundamental pharmacology knowledge	
2.	Learn various drug action on the nervous system, respiratory system and digestive system	
3.	Help students comprehend the ideas behind how pharmaceuticals work and the mechanisms at play.	
Course I	:	Core-07
Course title	:	PHARMACOLOGY AND TOXICOLOGY
Credits	:	5
Pre-requisite:		
Students should know the An introduction to cancer biology, Enhanced the imaging techniques and cancer therapy.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Discuss the pharmacotherapy of certain diseases. Explain the mechanism of drug actions at cellular and molecular level	K1 & K2
2.	To understand the pharmacological actions of different categories of drugs. And concepts of drug action and mechanism involved.	K2 & K4
3.	Apply the basic pharmacological knowledge in the prevention and treatment of diseases.	K3 & K5
4.	Appreciate correlation of pharmacology with other bio medical sciences. Further, to understand what drugs do to the living organisms and how their effects can be applied to therapeutics?	K4 & K6
5.	Understand the therapy and prevention	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Units	
I	Introduction to pharmacology: Scope of pharmacology: Introductory class to define pharmacology, historical background and limitations Pharmacokinetics: Absorption- Routes of administration of drugs, their advantages and disadvantages. Various processes of absorption of drugs and the factors affecting them. Adsorption, metabolism, distribution and excretion of drugs. Pharmacodynamics: General mechanism of drug action and the factors, which modify drug action.
II	Pharmacological classification of drugs; the discussion of drugs should emphasize the following aspects: Drugs acting on the central nervous system: Anesthetics, pshychofarmacological agents. Drugs acting on the autonomic nervous system: Cholinergic drugs, anticholinergic drugs, anticholinesterase drugs, Adrenergic drugs and adrenergic receptor blockers, Neuron blockers and ganglion blockers, Neuromuscular blockers, drugs used in myasthenia gravis.
III	Pharmacology of Central Nervous System: General anesthetics, sedatives, hypnotics, opioid Analgesics, Anti-Anxiety, Cognition enhancers. Pharmacology of drugs acting on ANS: Adrenergic and cholinergic drugs Pharmacology of Peripheral Nervous System: Local Anaesthetics, Skeletal Muscle Relaxants, Anti-inflammatory drugs.
IV	Hormones and hormone antagonists, Drugs acting on the respiratory system- bronchodilators, expectorants and antitussive agents, Drugs acting on the digestive system, Cardiovascular drugs, cardiotonics, antianginal agents, antihypertensive agents, peripheral vasodilators and drugs used in atherosclerosis, coagulants and anticoagulants.
V	Toxicology: Principles of toxicology. Acute, sub-acute and chronic toxicity, ICH Guidelines on Safety Studies, Reproductive Toxicology- Risk Assessment in Reproductive Toxicity, Mutagenicity- Mechanism of Mutagenesis, Carcinogenicity, Toxicokinetics. Abnormal action of drugs such as tolerance, addiction, habituation, idiosyncrasy, allergy, hypersensitivity, antagonism, synergism, potentiation, tachyphylaxis, adverse drug reactions.
Reading list	
1. Satoskar, R. S., Bhandarkar, S. D., & Ainapure, S. S. (1997). Pharmacology and pharmacotherapeutics. Indian Journal of Pharmacology, 29(5), 330.	
2. Katzung, B.G., Trevor AJ (2015) Basic and Clinical Pharmacology, McGraw-Hill Education, 13th Edition.	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Recommended texts

1. August, J.T., Anders, M.W., Murad, F., & Coyle, J.C (eds.) (1994). Advances in Pharmacology (1st ed.). Academic Press
2. Barile, F. A. (2013). Principles of Toxicology Testing (2nd ed.). CRC Press.
3. H. L. Sharma, K. K. Sharma, (2017). Principles of Pharmacology, Paras Medical Publishers, 3rd Edition,
4. Regulatory Toxicology, Second Edition, Christopher P Changelis, Shayne Cox Gad, Joseph F Holson, Publisher: Informa Healthcare
5. Laurence L. Brunton, Bjorn C. Knollmann, Randa Hilal-Dandan, "Goodman and Gilman's.
6. "The Pharmacological Basis of Therapeutics", 13th edition, McGraw-Hill Education / Medical, 2017.
7. Klaassen, Curtis D., and John B. Watkins. Casarett & Doull's essentials of toxicology. McGraw Hill Professional, 2015.

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-III

(For the students admitted in the academic year 2023-2024 onwards)

LAB COURSE -III

Lab Course-03

Paper Code: 23UPBMS1L03

Total Contact Hours: 108

Credits: 5

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	Learn the routes of administration in animal model.	
2.	Understand the effect of drugs action and general anesthesia.	
3.	Learn the acute toxicity in given drugs. Understand the specific activity of enzymes in rat brain homogenate.	
Course I	:	Core III
Course title	:	LAB COURSE -III (Immunology, pharmacology and toxicology)
Credits	:	5
Pre-requisite:		
Students should experiment to measure and identify the molecular changes via various techniques.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Know about animal model studies.	K1 & K2
2.	Understand the Effect of drugs.	K2 & K4
3.	Examine detection of pesticides.	K3 & K5
4.	Understand about the acute toxicity.	K4 & K6
5.	Understand the therapy and prevention	K5 & K6

M.Sc., Biomedical Science, Department of Zoology, Periyar University

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	1. Animal handling and precautions. 2. Study the routes of administration.
II	3. Analgesic effect of diclofenac on mice or rat. 4. Study the effects of acetylcholine (Ach) and plot the dose-response curve. 5. Study the effect of general anesthesia with ketamine 6. Determine the effect of promethazine on phenobarbitone induced sleeping time in mice. 7. Determine the acute toxicity of a given drug. 8. Calculate the LD50 value. 9. Detection of organophosphorous pesticides in biological sample. 10. Test the presence of paracetamol in the given biological sample. 11. Study the effect of organophosphate malathion on the specific activity of the enzyme acetylcholinestrerase in rat brain homogenate
	Spotters:

REFERENCE BOOKS:

1. Chisholm-Burns, M. A., Wells, B. G., & Schwinghammer, T. L. (2016). Pharmacotherapy principles and practice. McGraw-Hill.
2. Sharma, R. K. (2008). Practical and viva in Forensic Medical Toxicology, (1st ed.). Vitasta Publishing Pvt. Ltd.

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

VACCINOLOGY

Core-Industrial Module-08

Paper Code: 23UPBMS1C08

Total Contact Hours: 108

Credits: 4

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	The emphasis of the course is on the development of molecular diagnostic technologies and the molecular underpinnings of diseases.	
2.	It provides a succinct explanation of signal transduction, including its function in human diseases and therapeutic approaches.	
3.	The course will also focus on the problems associated with antibiotic resistance as well as the molecular mechanisms of numerous diseases, including HIV, HCC, Tuberculosis, Dengue, and SARS.	
Course I	:	Industrial Module-Core-08
Course title	:	VACCINOLOGY
Credits	:	4
Pre-requisite:		
Students should know the An introduction to cancer biology, Enhanced the imaging techniques and cancer therapy.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Aware of the strategies available for developing an innovative vaccine technology with different mode of vaccine delivery.	K1 & K2
2.	Able to explain the significance of critical antigens, immunogens and adjuvants in developing effective vaccines.	K2 & K4
3.	Understand the process of the function and development of vaccine	K3 & K5
4.	Describe the fundamental ideas behind the vaccine research and design	K4 & K6
5.	Aware of the regulatory issues, guidelines for the	K5 & K6

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	management of production of vaccine.	
--	--------------------------------------	--

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Immunological concepts in Vaccinology: Short history of vaccination, requirements for induction of immunity, Epitopes, linear and conformational epitopes, characterization and location of APC, MHC and immunogenicity, Rationale vaccine design based on clinical requirements: Hypersensitivity, Immunity to Infection, Autoimmunity, immunodeficiency, mechanism of adjuvant action, Scope of future vaccine strategies.
II	Classification of vaccines and its preparations: Active and passive immunization; Viral/bacterial/parasite vaccine differences, methods of vaccine preparation – Live, killed, attenuated, sub unit vaccines; Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines, edible vaccines, reverse vaccinology, combination vaccines, therapeutic vaccines; Peptide vaccines, conjugate vaccines; Cell based vaccines.
III	Vaccine research and design: Fundamental research to rational vaccine design. Antigen identification and delivery, T-Cell expression cloning for identification of vaccine targets for intracellular pathogens, Fundamentals of Immune recognition, implications for manipulating the T-Cell repertoire, Targeting Dendritic cells; a rational approach for Vaccine development, Cellular basis of T- Cell memory, Rational design of new vectors, CpG adjuvant activity, Transcutaneous immunisation, Vaccination studies and recent advances in Malaria, Tuberculosis, HIV.
IV	Computational tools for vaccine design: Antigen Sequence analysis, Epitope Mapping, Predictions of Immunogenic peptides of T-Cell and B-Cells. Prediction of HLA binding peptides, Comparative Genomics as a tool for vaccine design, introduction to online epitope databases.
V	Animal testing, commercialization, quality control: Quality control and regulations in vaccine research, In-vitro experimental validations for predictions of vaccines by software, Animal testing, Rational design to clinical trials, Large scale production, Commercialization, ethics.
Reading list	
1. Ronald W. Ellis, “New Vaccine Technologies”, Landes Bioscience, 2001. 2. Cheryl Barton, “Advances in Vaccine Technology and Delivery”, Espicom Business Intelligence, 2009. 3. Male, David et al., “Immunology”, 7th Edition, Mosby Publication, 2007.	
Recommended texts	
1. Coico, R. etal., “Immunology: A Short Course”, 5th Edition, Wiley – Liss, 2003.	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

2. Parham, Peter "The Immune System", 2nd Edition, Garland Science, 2005.
3. Abbas, A.K. et al., "The Cellular and Molecular Immunology", 6th Edition, Sanders / Elsevier, 2007.
4. Weir, D.M. and Stewart, John "Immunology", 8th Edition, Churchill Pvt. Ltd., 2000

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

ORGAN ON CHIP

Elective Course-05

Paper Code: 23UPBMS1E05

Total Contact Hours: 54

Credits: 3

Weekly Contact Hours: 3

Course Objectives:		
The main objectives of this course are:		
1.	To provides the potential informations at multiple stages of the drug discovery and development process using Organs-on-chips	
2.	It delivers a succinct explanation of structure and function of human vital organs and related cell lines.	
3.	The course will also focus on the developer's Guide to an Organ-on-Chip as well as current scenario of Organ on chip technologies.	
Course I	:	Elective Paper-05
Course title	:	ORGAN ON CHIP
Credits	:	3
Pre-requisite:		
Students should know the Developer's guidelines of Organ on chip and their applications in biomedical research.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Aware of the strategies available for innovative devices could provide insights into normal human organ function and disease pathophysiology	K1 & K2
2.	Able to explain the significance of development of organ-on-chip models requires an integrated interdisciplinary approach merging technologies and concepts	K2 & K4
3.	Understand the process of the function and development of Organ On Chip	K3 & K5
4.	Describe the fundamental ideas behind the concepts and applications of Organ on a chip model	K4 & K6
5.	Aware of the regulatory issues, implementation, and offers suggestions for directions next generation.	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Units	
I	Structure and functions of Vital organs of human – Liver, Kidney, Gastrointestinal tract, Brain, spleen, Pancreas. Histology of vital organs.
II	Commercially available Cell lines of Liver: Properties and culture of HepG2, Hep3B, HBG, and HepaRG. Kidney: Properties and culture of HEK-293 (Human Embryonic Kidney cell line), COS (African green monkey kidney cell line), CTR (pig kidney cell line), Gastrointestine: Properties and culture of HCT116, HT-29 cells, Caco ₂ cells.
III	Brain: Properties and culture of neural progenitor cells (NPCs) and hTERT NF1 ipNF05.5 (Mixed clones). Spleen: Properties and culture of Human Spleen Endothelial Cells (HSEC), Human Spleen Fibroblasts, Human Spleen Epithelial Cells Pancreas: Properties and culture of Immortalized Mouse Pancreas Epithelial Cells-Conditionally (IMPE), PANC-1, HuP-T3, CFPAC-1, HuP-T4, PSN-1
IV	Developer’s Guide to an Organ-on-Chip: Model Organs-on-a-chip design concept and key components- Principle and structural components of Microfluidic system, Tissue sources of organ on chip, Design concept, Fluid shear force, Concentration gradient, Dynamic mechanical stress, Cell patterning. Comparison of 2D and 3D Cell Culture.
V	Current scenario of Organ on chip technologies. Sources of Cells-human tissue, biopsy samples, stem cells, induced pluripotent cells (IPC), Liver on a chip, Lung on a chip, kidney on a chip, Heart on a chip, Intestine on a chip, multy-organ on a chip. Applications of Organ on Chip in Pharma industry, Medicine and Biomedical Research.
Reading list	
<ol style="list-style-type: none"> 1. Yu-suke Torisawa and Yi-Chung Tung.2020. Organs-on-chips. Published in Micromachine. CC BY licence, ISBN 978-3-03928-917-2 (paperback); ISBN 978-3-03928-918-9 (PDF). 2. Lucie A Low and Danilo A Tagle. 2017. Organs-on-chips: Progress, challenges, and future directions. Exp Biol Med (Maywood). 242(16): 1573–1578. 3. Cho S, Lee S, Ahn SI.2023. Design and engineering of organ-on-a-chip. Biomed Eng Lett. 13 (2):97-109. 	
Recommended texts	
Julia Rogal, Katharina Schlünder, and Peter Loskill.2022. Developer’s Guide to an Organ-on-Chip Model. ACS Biomater Sci Eng. 8(11): 4643–4647.	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10

M.Sc., Biomedical Science, Department of Zoology, Periyar University

CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-III
 (For the students admitted in the academic year 2023-2024 onwards)

IVF TECHNOLOGY

Non Major Elective Paper -02

Paper Code: 23UPBMS1N02

Total Contact Hours: 54

Credits: 2

Weekly Contact Hours: 3

Course Objectives:		
The main objectives of this course are:		
1.	The emphasis of the course is on the handling and manipulation of gametes and embryos.	
2.	The course aims to reinforce students' fundamental of ethical and national legal issues involved in reproductive medicine	
3.	The course will also focus on the Gamete and embryo culturing technique	
Course I	:	Non Major Elective Paper-02
Course title	:	IVF TECHNOLOGY
Credits	:	2
Pre-requisite:		
Students should know the An introduction to evolution of different technologies in Artificial Reproductive Technologies		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Aware of the strategies available for developing innovative technologies in artificial reproductive.	K1 & K2
2.	To provide the candidate with every opportunity to gain proficiency in clinical workup, diagnosis and evidence based management of infertile couple.	K2 & K4
3.	Understand the process of infertile couple with combined factor	K3 & K5
4.	Understand the actions of third party reproduction like oocyte donation, sperm donation, surrogacy etc.	K4 & K6
5.	To work independently as a consultant / clinician in Reproductive Medicine. .	K5 & K6

M.Sc., Biomedical Science, Department of Zoology, Periyar University

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	The regional anatomy and physiology of the female and male reproductive organs and hormonal regulations. The sexual differentiation and Chromosomal abnormalities involved in reproduction.
II	Gametogenesis, fertilization, implantation and embryo development. Development of the reproductive organs and abnormalities associated with it. Significance of foetal malformations.
III	Semen analysis, processing of semen for various procedures – intrauterine insemination, IVF/ICSI. Processing samples of testicular / epididymal sperms for ICSI and sperm function tests.
IV	Evolution of different technologies in Artificial Reproductive Technologies. Controlled ovarian stimulation, oocyte retrieval and embryo transfer techniques - IUI, IVF, ICSI, PESA, TESA, TESE.
V	The epidemiology, etiology, investigations and management of female and male infertility. Ethical and national legal issues involved in reproductive medicine and ART.

1. Reading list

1. Textbook of Assisted Reproductive Techniques David K. Gardner, Ariel Weissman, Colin M. Howles, Zeev Shoham
2. Principles and Practice of Assisted Reproductive Technology, Vol. 2, Lab. Aspects of IVF & Andrology, - Kamini Rao.

Recommended texts

1. Infertility Diagnosis, Management & IVF – Dr. Anil Dubey.
2. A Practical Guide to Setting Up an IVF Lab, Embryo Culture Systems and Running the Unit Alex
3. C Varghese, Peter Sjoblom, K. Jayaprakasan, April 2013.

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L - Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-IV
 (For the students admitted in the academic year 2023-2024 onwards)

HUMAN EMBRYOLOGY AND ENDOCRINOLOGY

Core Paper-09

Paper Code: 23UPBMS1C09

Total Contact Hours: 108

Credits: 5

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	To become familiar with comprehend normal anatomy and physiology of the male and female reproductive system.	
2.	To able to process spermatozoa obtained from Spermatozoa Retrieval Techniques.	
3.	The student will become familiar with assess viability of embryos and their developmental competence with fair accuracy.	
Course I	:	Core-09
Course title	:	HUMAN EMBRYOLOGY AND ENDOCRINOLOGY
Credits	:	5
Pre-requisite:		
Basic knowledge of molecular biology, recombinant DNA technologies and bioinformatics.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Know about basics of development: cleavage pattern, blastula and gastrula formation.	K1 & K2
2.	Knowledge about morphogenesis, organogenesis in animal embryo and sex determination.	K2 & K4
3.	Understanding the basic concept of hormones.	K3 & K5
4.	Understand the structure and function of endocrine glands in human.	K4 & K6
5.	Knowledge about the endocrine disorders and related pathophysiology in human beings.	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Units	
I	Basic concepts of development: Types of eggs and their Polarity, biological symmetry and chemo-differentiation of eggs. Gametogenesis: Spermatogenesis, Oogenesis and vitellogenesis. Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; Genes contributing to gonad development – Role of SF1, WT1, SRY, SOX 9 and other genes.
II	Role of maternal contribution in early embryogenesis – masked RNA. Molecular perspectives of fertilization: Recognition of egg and sperm, Egg and sperm interaction, fertilization, species – specific recognition, cortical reaction, activation of egg metabolism, fusion of genetic material. Artificial insemination: IUI, IVF
III	Cleavage and its patters, biochemical changes during cleavage, influence of male and female pronuclei during early development, blastula and gastrula and morphogenetic movements. Nuclear transplantation experiments in amphibians – Embryonic stem cell and its application. Genes that pattern <i>Drosophila</i> body plan: morphogenetic gradients, cascades and signaling pathways in <i>Drosophila</i> development – Homeo box concept and its role.
IV	Role of hormones in male reproductive physiology: Endocrine control of testicular function GnRH and Pituitary Gonadotropins, inhibin and prolactin. Physiological roles of Androgens – Spermatogenesis, secondary sex characteristics, anabolic actions and ageing. Mechanism of Androgen action-Androgen receptors. Physiological roles of estrogens- fertility, male behavior, Epiphyseal fusion. Role of hormones in female reproductive physiology: Ovarian steroid hormones (OSH)- Estrogen, Progesterone, Androgens and their mechanism of action -Estrogen receptors. Physiological roles of OSH, prostaglandins, oxytocin and vasopressin. Mammalian reproductive cycle –Primate menstrual cycle, induced and spontaneous ovulators, delayed implantation Menopause and hormone replacement therapy
V	Disorders of Reproductive system: Infertility: Causes - Male factors and female factors, Couple Dependent Factors, Toxic Exposures. Methods of IVF - ICSI, ZIFT, GIFT and PGD, disadvantages of IVF. Embryo cryopreservation and sperm bank. Recurrent pregnancy loss: Causes and treatment– Genetic, Hormonal, Metabolic and other factors; Rh incompatibility overview. Pathophysiology - Dysmeorrhoea, Amenorrhoea, Polycystic Ovary Syndrome, premature ovarian failure, premenstrual syndrome, Infections in Pregnancy, High risk pregnancy Causes, Diagnosis and prevention.
Reading list	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

1. Frederick R Bailey (2018), Text-Book of Embryology, Forgotten Books.
2. Datta A. K. (2017), Essentials of Human Embryology (7th Ed.), Current Books International
3. Subhadra Devi V (2017), Inderbir Singh's Human Embryology (11th Revised Ed.), Jaypee Brothers Medical Publishers
4. Vishram Singh (2017) Textbook of Clinical Embryology, Elsevier
5. Scott F. Gilbert (2016), Developmental Biology (11th edition), Sinauer.
6. Sadler (2016), Langman's Medical Embryology (13th Ed.), Wolters Kluwer.
7. Tickle, Martinez Arias Wolpert (2015), Principles of Development 5th Ed) Oxford University Press.

Recommended texts

1. Carlson (2013), Human Embryology and Developmental Biology (5th Ed), Elsevier Health – US
2. Balinsky B.I. (2012), An Introduction to Embryology (5 Ed.), Cengage Learning India.
3. Das N (2012), Fundamental Concepts of Developmental Biology, Affiliated East-West Press Pvt. Ltd. New Delhi.
4. Gerald P. Schatten (2006) Current Topics in Developmental Biology (1st Ed.), Academic Press.
5. Jonathan M. W. Slack (2005), Essential Developmental Biology, (2nd Ed), Wiley-Blackwell
6. Lewis Wolpert, Rosa Beddington, Thomas Jessell, Peter Lawrence, Elliot Meyerowitz, Jim Smith (2001), Principles of Development (2nd Edition), OUP Oxford
7. Textbook of Gynecology; D.C Dutta
8. Endocrinology (5th edition); Mac E. Hadley
9. Obstetrics and Gynaecology-2 –For postgraduates and Practitioners.

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-IV
(For the students admitted in the academic year 2023-2024 onwards)

BIOMATERIAL AND TISSUE ENGINEERING

Core Paper-10

Paper Code: 23UPBMS1C10

Total Contact Hours: 108

Credits: 5

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
1.	Understand the basic concepts of biomaterials implant and tissue interactions.	
2.	Learn applications of biomaterials in various body parts.	
3.	Describe the Biological response of implanted materials.	
Course I	:	Core -10
Course title	:	HUMAN EMBRYOLOGY AND ENDOCRINOLOGY
Credits	:	5
Pre-requisite:		
Basic knowledge of molecular biology, recombinant DNA technologies and bioinformatics.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Know about applications of natural and degradable polymers for tissue engineering	K1 & K2
2.	Acquire knowledge on the biomaterials, implant and tissue engineering.	K2 & K4
3.	Understand the desirable and undesirable reactions of the body with implanted materials.	K3 & K5
4.	Know the therapeutic strategies using biomaterials	K4 & K6
5.	Acquire knowledge about tissue engineering and bioactive scaffold.	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Units	
I	Introduction of biomaterial, types of biomaterials, advantages and disadvantages., Bio ceramics for implant coating, calcium phosphates, hydroxy apatite Ti6Al4V and other biomedical alloys, implant and tissue interaction.
II	Advantages of nanomaterials use as implants, biological response of implanted materials, desirable and undesirable reactions of the body with implanted materials. Materials used for orthopaedic implants, bioceramics, modes of failure.
III	Materials used for dental, modes of dental implant failure, wear debris, materials used for cartilage and vascular, bladder, modes of cartilage implant, vascular implant, implant failure study, modes of bladder implant failure.
IV	Protein interactions with implanted materials, cellular recognition of proteins adsorbed on material surfaces, adhesion, migration, differentiation, cellular extra cellular matrix deposition leading to tissue regeneration, foreign-body response, inflammatory response. Tissue engineering introduction, stem cells, morphogenesis, generation of tissue in the embryo, tissue homeostasis, cellular signaling, extracellular matrix as a biologic scaffold for tissue engineering, scaffold fabrication, bioactive scaffold, natural polymers in tissue engineering applications, degradable polymers for tissue engineering.
V	Biocompatibility & Toxicological screening of biomaterials: Definition of biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and chronic toxicity studies (in situ implantation, tissue culture, haemolysis, thrombogenic potential test, systemic toxicity, intracutaneous irritation test), sensitization, carcinogenicity, mutagenicity and special tests.
Reading list	
<ol style="list-style-type: none">1. Biomaterial Science: An Introduction to Materials in Medicine, By Buddy D. Ratner, et.al. Academic Press, San Diego, 19962. Sujata V. Bhat, Biomaterials, Narosa Publishing House , 2002.3. J B Park, Biomaterials-Science and Engineering, Plenum Press, 1984. Vishram Singh (2017) Textbook of Clinical Embryology, Elsevier .	
Recommended texts	
<ol style="list-style-type: none">1. Basu, B. (2017). Biomaterials science and tissue engineering: principles and methods. Cambridge University Press.	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

2. Miller, E. G. (2006). Artificial Organs. Morgan & claypool publishers.
3. Ong, J. L., Appleford, M. R., & Mani, G. (2014). Introduction to biomaterials: basic theory with engineering applications. Cambridge University Press.
4. Poole, D. L., & Mackworth, A. K. (2010). Artificial Intelligence: foundations of computational agents. Cambridge University Press.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

M.Sc., Biomedical Science, Department of Zoology, Periyar University

PERIYAR UNIVERSITY SALEM -636 011

Department of Zoology

M.Sc., Biomedical Science Programme-SEMESTER-IV

(For the students admitted in the academic year 2023-2024 onwards)

PROJECT WORK AND VIVA VOCE

Project-01

Paper Code: 23PUBMS1P01

Total Contact Hours: 180

Credits: 7

Weekly Contact Hours: 10

Course Objectives:		
The main objectives of this course are:		
1.	To gain research knowledge.	
2.	To know how to execute independent research.	
Course I	:	Project-01
Course title	:	PROJECT WORK AND VIVA VOCE
Credits	:	7
Pre-requisite:		
To gain research knowledge and to know how to execute independent research.		
Expected Course Outcome:		
Upon completion of this lab course, the students		
1.	At the completion of this course, students will be able to do independent research at national and international standard.	K3, K4, K5, K6

K1- Remember; K2- Understand; K3- Apply; K4-Analyze; K5-Evaluate; K6- Create

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-IV
(For the students admitted in the academic year 2023-2024 onwards)

NANOMEDICINE AND DRUG DESIGNING

Elective Course -06

Paper Code: 23UPBMS1E06

Total Contact Hours: 72

Credits: 3

Weekly Contact Hours: 4

Course Objectives:		
The main objectives of this course are:		
1.	To acquire knowledge about nanomaterials and its applications in the field of nanomedicine.	
2.	Understanding methods of drug delivery to the targets using nanoparticles.	
3.	Understanding treatment strategies for human diseases, through nanotherapeutics.	
Course I	:	Elective Course -06
Course title	:	NANOMEDICINE AND DRUG DESIGNING
Credits	:	3
Pre-requisite:		
Basic knowledge in Diagnostics		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Comprehend the importance and principle of Nanostructure	K1 & K2
2.	Illustrate the chemical, physical and biological properties of nanomaterials. And describe various methods of synthesizing nanomaterials.	K2 & K4
3.	Know the characterization methods of nanoparticles. Elucidate the mechanism of transporting nanomaterials across living cells.	K3 & K5
4.	Explain various applications of Nanomaterials	K4 & K6
5.	Knowledge pertaining to challenges, toxicity and future of nanotechnology.	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Units

M.Sc., Biomedical Science, Department of Zoology, Periyar University

I	Introduction to Nanotechnology, Nano-scaling, Various Structures and synthesis of Nanomaterials: Top-down (Nanolithography, CVD), Bottom-up (Sol-gel processing, chemical synthesis). Wet deposition techniques. Properties of nanoscale materials (optical, electronic and magnetic). Rationale for designing of nanomedicines.
II	Characterization of Nanomaterials, Spectroscopic techniques – UV visible and infrared spectroscopy, Raman spectroscopy, X-ray diffraction, Microscopy - SEM, TEM, AFM, etc. Characteristics and Biocompatibility of nanoparticles.
III	Basics of drug delivery, Types - polymer, lipid, metal-based drug delivery system and miscellaneous. Targeted delivery- Active and passive targeting - Enhanced permeability and retention effect, multifunctional property of nanoparticles. Nanomedicines for various disease conditions: infectious diseases, neurological diseases: (challenges of blood brain barrier), pulmonary disorders, cardiovascular diseases, cancer: nano-chemotherapy, radiation therapy, immunotherapy, nuclear medicine therapy, photodynamic therapy, photothermal and RF hyperthermia therapy, scintillation therapy, gene-therapy: DNA, RNA delivery. Theranostic nanomedicines: Basic concept, multifunctional nanomedicines for theragnosis.
IV	A general introduction and historical perspective on drug discovery and development: General introduction to drug discovery research and development, history of drug discovery research and development. In-silico drug designing: Basics of structural bioinformatics, Role of Bioinformatics in drug design, Target understanding at molecular level, lead optimization and in-silico validation, Structure- and ligand-based drug design, Molecular docking and docking algorithms, de-novo ligand design and molecular dynamics simulation.
V	Drug Screening: Understanding protein-protein, protein-small molecule interaction study, Role of Structural Biology in Drug Discovery, Cell-free and cell-based assays, exploiting cell biology to design assay platforms, High-throughput screening, Introduction to High Content Screening, Designing and development of disease model. Medicinal Chemistry, Pharmacology and Drug Development: Small molecules as drugs, Lipinski rule five, hit identification to lead development process. Drug Repurposing: Drug discovery via drug repurposing, Strategies of drug repurposing, Approaches and methodologies of drug repurposing
Reading list	
Nanomedicine for Cancer Therapy: From Chemotherapeutic to Hyperthermia-Based	

M.Sc., Biomedical Science, Department of Zoology, Periyar University

Therapy ,
 Springer, Piyush Kumar, RohitSrivastava, 2017
 2. Nanotoxicology, Materials, Methodologies, and Assessments, Editors: Durán,
 Nelson, Guterres, Silvia S., Alves, OswaldoLuiz (Eds.),

Recommended texts

1. Nanomedicine – P.K.Sharma.
2. Medical Nanotechnology and Nanomedicine (Perspectives in Nanotechnology)by Harry F.Tibbals and H.F. Tibbals (2010)
3. The Handbook of NanomedicinebyK. K. Jain (2010)

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-IV
(For the students admitted in the academic year 2023-2024 onwards)

MOLECULAR DIAGNOSIS

Skill Enhancement Course-02

Paper Code: 23UPBMS1S02

Total Contact Hours: 72

Credits: 2

Weekly Contact Hours: 4

Course Objectives:		
The main objectives of this course are:		
1.	Learn about cutting-edge methods used in clinical diagnosis of diseases, as well as the advantages of molecular diagnostics in precision diagnosis.	
2.	Gain knowledge of the technical aspects of the assays that will be used to create new tests for better diagnosis.	
3.	Acquire knowledge of current examples, which fosters critical thought and can aid in the creation of examinations. Thorough understanding of the ethical and legal implications of handling clinical samples and running tests on them.	
Course I	:	Skill Enhancement Course -01
Course title	:	MOLECULAR DIAGNOSIS
Credits	:	2
Pre-requisite:		
Basic knowledge in Diagnostics		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Knowledge of disease classification and diagnosis. Learn about the legal and moral considerations that go into conducting diagnostic tests.	K1 & K2
2.	Learn the technical details of numerous diagnostic approaches so that you can use these strategies to create new clinical tests.	K2 & K4
3.	Learn in-depth information about the many biotechnological studies conducted to track changes occurring at various molecular levels. To analyse and use biological assays to construct clinical tests, one must be aware of their particularities and potential problems.	K3 & K5

M.Sc., Biomedical Science, Department of Zoology, Periyar University

4.	When using molecular techniques in practice, learn how to evaluate the data.	K4 & K6
5.	Learn about the significant disorders that can be detected utilising molecular diagnostic techniques. Discover how to use precision diagnostics in managing diseases.	K5 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Introduction and History of diagnostics, Diseases- infectious, physiological and metabolic errors, genetic basis of diseases, inherited diseases. Infection – mode of transmission in infections, factors predisposing to microbial pathogenicity, types of infectious diseases- bacterial, viral, fungal, protozoans and other parasites. Philosophy and general approach to clinical specimens, Sample collection- method of collection, transport and processing of samples, Interpretation of results, Normal microbial flora of the human body, Host - Parasite relationships.
II	Cytogenetics - Karyotype analysis, blood, bone marrow, amniotic fluid, chorionic villus samples, products of conception Fluorescent in situ hybridization, Cytogenetic studies using microarrays. Molecular DNA isolation and quantification, Probe and primer designing, PCR -standard and various modifications, Real time PCR, Multiplex Ligation-dependent Probe Amplification (MLPA) analysis, SNP, Single-strand conformation polymorphism (SSCP).
III	PCR based assays: Real-time PCR, ARMS, allele specific, multiplex, methylation analysis, MLPA, single-stranded conformational polymorphism analysis, heteroduplex analysis, competitive oligonucleotide priming, DHPLC, DGGE, CSCE. Mutation screening panels (xTAG, Luminex) Micro arrays: SNP chromosomal microarrays, EST, SAGE.
IV	Applications of Molecular Diagnostics: Major Histocompatibility Complex (MHC), HLA typing RFLP, PCR based methods, SSO, SSP and SBT methods. Role of Molecular diagnostics in bone marrow transplantation and organ transplantation. Bone marrow transplant engraftment analysis. Diagnosis of inherited diseases- Thalassemia, Cystic Fibrosis. Neonatal and Prenatal disease diagnostics Prenatal and pre-implantation diagnosis. Noninvasive: Triple test, Ultrasonography (USG), Invasive: Amniocentesis (AC), chorionic villi sampling. Molecular diagnosis for early detection of cerebral palsy, Down syndrome. Fragile X syndrome.
V	Applications In Molecular Oncology And Microbial Diseases: Molecular oncology testing in malignant disease- Acute and Chronic leukemias, Melanoma, colon, lung and breast cancers. Circulating

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	tumour cell testing (CTC). Molecular diagnosis of various viral diseases: Dengue, Chikungunya and SARS. Direct detection & identification of pathogenic-organisms that are slow growing or currently lacking a system of in vitro cultivation as well as genotypic markers of microbial resistance to specific antibiotics- 16s rRNA typing.
Reading list	
Recommended texts	
<ol style="list-style-type: none"> 1. Tietz textbook of clinical chemistry and molecular diagnostics. Carl Burtis, Edward Ashwood, David Bruns, Elsevier Press. 5th Edition 2012. 2. Principles and Techniques of Biochemistry and Molecular Biology. Keith Wilson and John Walker. 2010 3. Molecular Diagnostics: Fundamentals, Methods and Clinical Applications. Lela Buckingham and Maribeth L. Flaws. 2011 4. Modern Blood Banking & Transfusion Practices. Denise M. Harmening. 2018 5. 5. Fundamentals of Molecular Diagnostics. David E. Bruns MD (Author), Edward R. Ashwood MD (Author), Carl A. Burtis PhD. 2007 6. Proteomics in Diagnostics. Veenstra, T.D. 2004. 	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-IV
(For the students admitted in the academic year 2023-2024 onwards)

EXTENSION ACTIVITY

Extension Activity-01

Paper Code: 23UPBMS1X01

Credits: 1

Course Objectives:		
The main objectives of this course are:		
1.	To awareness general public, and school children on diseases.	
2.	To bring social awareness on life style diseases.	
Course I	:	Extension Activity-01
Course title	:	Extension Activity
Credits	:	1
Pre-requisite:		
To gain professional learning experience and develop new skills in life science field.		
Expected Course Outcome:		
Upon completion of this lab course, the students		
1.	At the completion of this course, students will be able to know understanding of health, nutrition and other lifestyle and associated diseases	K3, K4, K5, K6

K1- Remember; K2- Understand; K3- Apply; K4-Analyze; K5-Evaluate; K6- Create

VALUE-ADDED COURSES

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-IV
 (For the students admitted in the academic year 2023-2024 onwards)

LIFE STYLE DISEASES

Value added Course-01

Paper Code: 23UPBMS1V01

Total Contact Hours: 36

Credits: 2

Weekly Contact Hours: 2

Course Objectives:		
The main objectives of this course are:		
1.	To create awareness among students about the various diseases arising from the day-to-day activities of people which could be prevented or managed by controlling the life style.	
2.	The course also covers the general aspects of diagnosis, methods of prevention and pharmaceutical intervention.	
Course I	:	Value Added Course [VAC] - 01
Course title	:	LIFE STYLE DISEASES
Credits	:	2
Pre-requisite:		
Basic knowledge in Diagnostics		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Obtain knowledge and understanding of health, nutrition and other lifestyle and associated diseases	K1 & K2, K4
2.	Develop own thinking, opinions and studies to global health issues.	K3 & K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Concept of lifestyle diseases- importance of lifestyle factors in preventing disease development: diet, exercise, smoking, alcohol etc.
II	Diabetes- Type 1 and type2, characteristics, causes, diagnosis, prevention and management.
III	Cancer: Characteristics, Causes, Diagnosis, Prevention, Management, basics of treatment modalities.
IV	Atherosclerosis and cardiovascular diseases- Myocardial infarction, congestive heart failure, ischemic diseases- Causes, diagnosis and

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	management.
V	Obesity- causes, prevention and management. Importance of diet and exercise in health- balanced diet, BMR, calorific value, reducing cholesterol and risk of heart attack through life style changes, use of medication to treat disorders.
Reading list	
Recommended texts	
<ol style="list-style-type: none"> 1. Murray, R. K., Granner, D. K., Mayes, P. A., Rodwell, V. W. (2017) Harper's Biochemistry. Prentice Hall International Inc. 2. Lehninger, A. L., Nelson, D. K., and Cox, M. M. (2015) Principles of Biochemistry. CBS Publishers and distributors, New Delhi. 3. Tannock IF and Hill RP (1998) The Basic Science of Oncology, Third edition, McGraw- Hill, New York. 4. Hall. J.E. Guyton and Hall (2011) Textbook of Medical Physiology. 12th ed. Saunders, Elsevier Inc. 	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-IV
 (For the students admitted in the academic year 2023-2024 onwards)

EXPERIMENTAL EMBRYOLOGY

Value added Course-02

Paper Code: 23UPBMS1V02

Total Contact Hours: 36

Credits: 2

Weekly Contact Hours: 2

Course Objectives:		
The main objectives of this course are:		
1.	To motivate the students to learn the basic concepts of Experimental Embryology.	
2.	To facilitate students to learn the molecular perspective of fertilization.	
Course I	:	Value Added Course [VAC] - 02
Course title	:	EXPERIMENTAL EMBRYOLOGY
Credits	:	2
Pre-requisite:		
Basic knowledge in Experimental Embryology		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	On successful completion of this course, the student will be Able to get an opportunity to work as a Lab Technician in fertility clinics and gaining knowledge to fit them to do research in the topic of interest	K1 & K2, K3, K4 & K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Units	
I	History and scope of embryology , Meiosis- A cell Division to generate germ cells. Morphogenetic movements: Process in morphogenesis and associated adhesion molecules-cadherins, Immunoglobulin like CAMS, selectins, Integrins and Role of CAMS and SAMS in morphogenesis. Cell migration-Route selection tug-of War between migratory cells and surrounding. Importance of western blot to identify proteins of embryo
II	Differentiations and classes of differentiations. Potency of cells-Uni, pleury, toti potency of embryonic cell. Gene control in differentiations. A molecular view of differentiations and role of cytoplasm in differentiations. Oogenesis and typrs of eggs. Spermatogenesis and cytoplasmic bridges of spermiogenesis and spermatogenesis

M.Sc., Biomedical Science, Department of Zoology, Periyar University

III	Fertilization: A multi-step process. Fertilization in mammals, calcification of sperm. Determination of sperm quality and counts. Reproductive cycle in women. Assessment of egg quality and hormone level in women. Formation of zygote and process of cleavage in human. Importance of fate map.
IV	Morulla formation, Fate of germ layers. Early development in mammals. Fertilization-cleavage-Gastrulation-Extra embryonic membrane-Axis formation-Determination of dorsal and ventral axis and determination of left and right axis. Neurulation-Placenta in man: Implantation, Hormonal control of implantation. Estimation of Hormones during pregnancy.
V	Semen Analysis, Monitoring embryo and selection of quality embryo. Embryo transfer, fertilization and embryo evaluation methods, Egg retrieval, oocyte microinjection and ICSI (Intra-cytoplasmic Sperm injection). Evaluation of Antifertility and infertility in male and female (Human). Principle and applications of IVF technique.
Reading list	
Recommended texts	
<ol style="list-style-type: none"> 1. Inderbir Singh and G.P. Pal 2013. Human Embryology, 9th Edition, Macmillan Publisher, India Ltd. 2. Veer Bala Rastogi: 2019.Chordata Embryology, Kadhar Nath Ramnath Publisher, India. 3. Lewis Wolpert.2008. The Triumph of the embryo. Dover Publications Inc. New York, USA. 4. William E. Kelleott 2023. A text Book of general Embryology, Maven Book Publisher, india 5. Sanjib chattopadhyay 2019.An Introduction to Developmental Biology. Books and Allied Pvt.Ltd Publisher, India. 	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

ADD-ON COURSES

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-IV
 (For the students admitted in the academic year 2023-2024 onwards)

CANCER THERAPEUTICS

Add-on Course-01

Paper Code: 23UPBMS1A01

Total Contact Hours: 36

Credits: 2

Weekly Contact Hours: 2

Course Objectives:		
The main objectives of this course are:		
1.	Students will gain knowledge of tumorigenesis, learn techniques commonly used in cancer biology	
2.	The fundamental principles behind cancer prevention, and therapeutic management.	
Course I	:	Add-on Course - 01
Course title	:	CANCER THERAPEUTICS
Credits	:	2
Pre-requisite:		
Basic knowledge in Cancer biology and choice of treatment		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	This course work provides chance to work in stem cells and cancer stem cells. There is a chance for the students to enter into the modern cancer and stem cell laboratories as scientist	K1 & K2, K3, K4 & K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Properties and characterization of cancer, comparison of cancer and normal cell, Types of cancers-Classification of cancer. Genetic basis of cancer: Oncogene and tumour suppressor gene.
II	Principles and methods of surgical oncology. Merits and demerits of cancer surgery. Cancer post-operative wound healing.
III	Mode of action of chemotherapeutic agent: Doxorubicin, cisplatin and tamoxifen. Development of multi drug resistance capacity against frequently used drugs. Need of combined therapy. The significance of radiation and chemotherapy in cancer management.
IV	Radiation therapy- Radiological Examination. Importance of radiotherapy, side effect of radiation therapy. Cancer immune-therapy:

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	Monoclonal antibody for cancer. Vaccine as immunotherapeutic agent
V	Nanotherapeutics- Principles of drug delivery systems, Nanodrugs for diagnosis and treatment of cancer; RNAi technology and Single molecule therapy for cancer.
Reading list	
Recommended texts	
<ol style="list-style-type: none"> 1. Tannock IF and Hill RP (1998) The Basic Science of Oncology, Third edition, McGraw- Hill, New York. 2. Bronchud MH, Foote M, Giaccone G, olopade O and Workman P(2017) Principles of Molecular Oncology, Fifth edition, Humana Press, New Jersey. 3. Depatin KM and Fulda S (2015) Apoptosis and Cancer Therapy, WILEY-VCHVerlag GmbH and Co., New York. 4. Hayatt MA (2016) Methods of Cancer Diagnosis, Therapy, and Prognosis, Vol-7; Springer, Netherlands. 5. Missailidis S (2012) Anticancer Therapeutics, John Wiley and Sons, Ltd., USA. 6. Lodish H, Kaiser CA, Brasher A, Amon A, Berk A, Kreger M, Ploegh H and Scott MP (2012). Molecular Cell Biology, 7th edition, Garland Publishing, Inc. New York. 	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low

PERIYAR UNIVERSITY SALEM -636 011
Department of Zoology
M.Sc., Biomedical Science Programme-SEMESTER-IV
 (For the students admitted in the academic year 2023-2024 onwards)

LAB ON CHIP

Add-on Course-02

Paper Code: 23UPBMS1A02

Total Contact Hours: 36

Credits: 2

Weekly Contact Hours: 2

Course Objectives:		
The main objectives of this course are:		
1.	Fundamentals and fabrication techniques of Lab on chip.	
2.	The fundamental principles, technical issues and applications of biomedical microdevices; lab-on-a-chip technologies.	
Course I	:	Add-on Course - 02
Course title	:	LAB ON CHIP
Credits	:	2
Pre-requisite:		
Basic knowledge in Lab on chip and vital organ and Human on chip.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	This course will offer students an opportunity to study fundamentals and basic concepts to explore applications of state-of-the-art of biomedical devices and lab-on-a-chip	K1 & K2, K3, K4 & K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Scope and applications of biomedical devices. Lab on chip: a multi-disciplinary approach. Mechano biology significance in Lab on Chip. Fluidics in Living System
II	Principles of microfluidics and microfluidic devices Sensing technologies in BioMEMS. Polymer microfabrication for BioMEMS and lab-on-a-chip.
III	Micro array Technology for Biological Macromolecules- DNA, protein, and cell based biosensors. Lab-on-a-chip miniaturized chemical/ biological analysers.
IV	Development of Smart Drug delivery system: Bio-availability, Bioaccumulation and Biocompatibility of drugs for <i>in vitro</i> , <i>in vivo</i> and ex

M.Sc., Biomedical Science, Department of Zoology, Periyar University

	<i>vivo</i> experiments.
V	Method of Case study Report preparation using BioMEMS and Recent developments in lab-on-a-chip technologies
Reading list	
Recommended texts	
<ol style="list-style-type: none"> 1. S. S. Saliterman, 2006. "Fundamentals of BioMEMS and Medical Microdevices," SPIE Press. 2. M. Madou, 2011. "Fundamentals of Microfabrication and Nanotechnology," 3rd ed., CRC Press. 3. E. Meng, 2011 "Biomedical Microsystems," CRC Press. 	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	M	S	L	M	S	S
CO4	L	M	S	S	L	S	M	S	M	M
CO5	S	M	S	M	S	S	M	M	S	S

*S - Strong; M - Medium; L – Low